SIGNAL

September 1959

INFRARED—WHERE IMAGINATION IS KING—See page 44

FOR TOP RELIABILITY

MILITARY AND INDUSTRIAL

HERMETIC AUDIO AND POWER COMPONENTS... FROM STOCK

UTC stock hermetic units have been fully proved to MIL-T-27A, eliminating the costs and delays normally related to initial MIL-T-27A tests. These rugged, drawn case, units have safety factors far above MIL requirements, and are ideal for high reliability industrial applications. Listed below are a few of the hundred stock types available for every application. **Industrial ratings in bold.**

Typical Miniature Audios

RC-28 Case
61/64 x 1-13/32 x 1-9/16
1.5 oz.

Type No	Application	MIL Type	Pri. Imp. Ohms	Sec. Imp. Ohms	Unbal. DC in Pri. MA	Response 2 db (Cyc.)	Max. level dbm
H-1	Mike, pickup. line to grid	TF4RX10YY	50, 200CT, 500CT	50,000	0	50-10,000	+ 5
H-2	Mike to grid	TF4RX11YY	82	135,000	50	250-8,000	+18
H-5	Single plate to P.P. grids	TF4RX15YY	15,000	95,000 CT	0	50-10,000	+ 5
H-6	Single plate to P.P. grids, DC in Pri.	TF4RX15YY	15,000	95,000 split	4	200-10,000	+11
H-7	Single or P.P. plates to line	TF4RX13YY	20,000 CT	150/600	4	200-10,000	+21
H-8	Mixing and matching	TF4RX16YY	150/600	600 CT	0	50-10,000	+ 8
H-14	Transistor Interstage	TF4RX13YY	10K/2.5K, Split	4K/1K split	4	100-10,000	+20
H-15	Transistor to line	TF4RX13YY	1,500 CT	500/125 split	8	100-10,000	+20

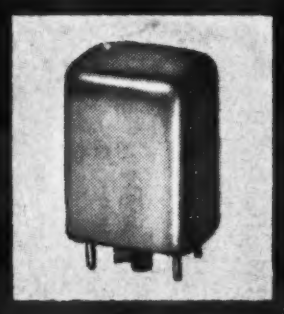
Type No.	Application	MIL Type	Pri. Imp. Ohms	Sec. Imp. Ohms	Unbal. DC in Pri. MA	Response + 2 db (Cyc.)	Max. level dbm
H-20	Single plate to 2 grids, can also be used for P.P. plates	TF4RX15YY	15,000 split	80,000 split	0	30-20,000	+12
H-21	Single plate to P.P. grids, DC in Pri.	TF4RX15YY	15,000	80,000 split	8	100-20,000	+23
H-22	Single plate to multiple line	TF4RX13YY	15,000	50/200, 125/500	8	50-20,000	+23
H-23	P.P. plates to multiple line	TF4RX13YY	30,000 split	50/200, 125/500	8 BAL.	30-20,000	+19
H-24	Reactor	TF4RX20YY	450 Hys.-0 DC, 250 Hys.-5 Ma. DC, 6000 ohms 65 Hys.-10 Ma. DC, 1500 ohms				
H-25	Mixing or transistors to line	TF4RX17YY	500 CT	500/125 split	20	40-10,000	+30

Typical Compact Audios

RC-50 Case
1-5/8 x 1-5/8 x 2-5/16
8 oz.

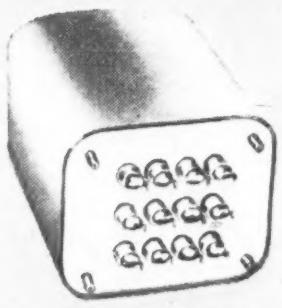
Typical Subminiature Audios

SM Case
1/2 x 11/16 x 29/32
.8 oz.



Type No	Application	MIL Type	Pri. Imp. Ohms	Sec. Imp. Ohms	Unbal. DC in Pri. MA	Response + 2 db (Cyc.)	Max. level dbm
H-31	Single plate to 1 grid, 3:1	TF4RX15YY	10,000	90,000	0	300-10,000	+13
H-32	Single plate to line	TF4RX13YY	10,000	200	3	300-10,000	+13
H-33	Single plate to low imp.	TF4RX13YY	30,000	50	1	300-10,000	+15
H-35	Reactor	TF4RX20YY	100 Henries-0 DC, 50 Henries-1 Ma. DC, 4,400 ohms.				
H-36	Transistor Interstage	TF4RX15YY	25,000 (DCR800)	1,000 (DCR110)	.5	300-10,000	+10
H-39	Transistor Interstage	TF4RX13YY	10,000 CT (DCR600)	2,000 CT	2	300-10,000	+15
H-40A	Transistor output	TF4RX17YY	500 CT (DCR26)	600 CT	10	300-10,000	+15

Type No.	HV Sec. CT	DC MA*	Military Rating Fil. Secs.	DC MA*	Industrial Rating Fil. Secs.	Case
H-80	450	120	6.3V,2A	130	6.3V,2.5A.	FA
H-81	500/550	65/55	6.3V,3A-5V,2A	75/65	6.3V,3A.-5V,2A.	HA
H-82	540/600	110/65	6.3V,4A.-5V,2A.	180/100	6.3V,4A.-5V,2A.	JB
H-84	700/750	170/110	6.3V,5A.-6.3V,1A.,5V-3A.	210/150	6.3V,6A.-6.3V,1.5A.-5V,4A.	KA
H-89	850/1050	320/280	6.3V,8A.-6.3V,4A.,5V-6A.	400/320	6.3V,8A.-6.3V,4A.-3V,6A.	OA



Typical Power Transformers

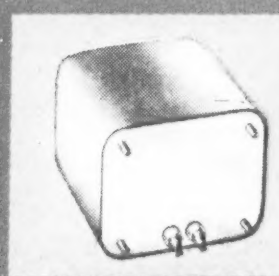
Pri: 115V 50/60 Cyc.
***Choke/Cond. inp.**

Type No.	Sec. Volts	Amps.	Test Volts	Case	Type No.	Sec. Volts	Amps.	Test Volts	Case
H-121	2.5	10(12)	10 KV	JB	H-131	6.3 CT	2(2.5)	2500	FB
H-122	2.5	20(26)	10 KV	KB	H-132	6.3 CT 6.3 CT	6(7) 6(7)	2500	JA
H-125	5	10(12)	10 KV	KB	H-133	6.3 CT	7(8)	2500	HB
H-130	6.3 CT	.6(.75)	1500	AJ	H-134	6.3 CT	10(12)	2500	HA

Typical Filament Transformers

Pri: 105/115/210/220V except H-130 (115) and H-131 (115/220) 50/60 Cyc.

Typical Filter Reactors



Type No.	MIL Type	Ind. Hys. @ MA DC	Ind. Hys. @ MA DC	Ind. Hys. @ MA DC	Ind. Hys. @ MA DC	Res. Ohms	Max. DCV Ch. Input	Test V. RMS	Case
H-71	TF1RX04FB	20 @ 40	18.5 @ 50	15.5 @ 60	10 @ 70	350	500	2500	FB
H-73	TF1RX04HB	11 @ 100	9.5 @ 125	7.5 @ 150	5.5 @ 175	150	700	2500	HB
H-75	TF1RX04KB	11 @ 200	10 @ 230	8.5 @ 250	6.5 @ 300	90	700	2500	KB
H-77	TF1RX04MB	10 @ 300	9 @ 350	8 @ 390	6.5 @ 435	60	2000	5500	MB
H-79	TF1RX04YY	.7 @ 800	6.5 @ 900	6 @ 1000	5.5 @ 1250	20	3000	9000	7x7x8

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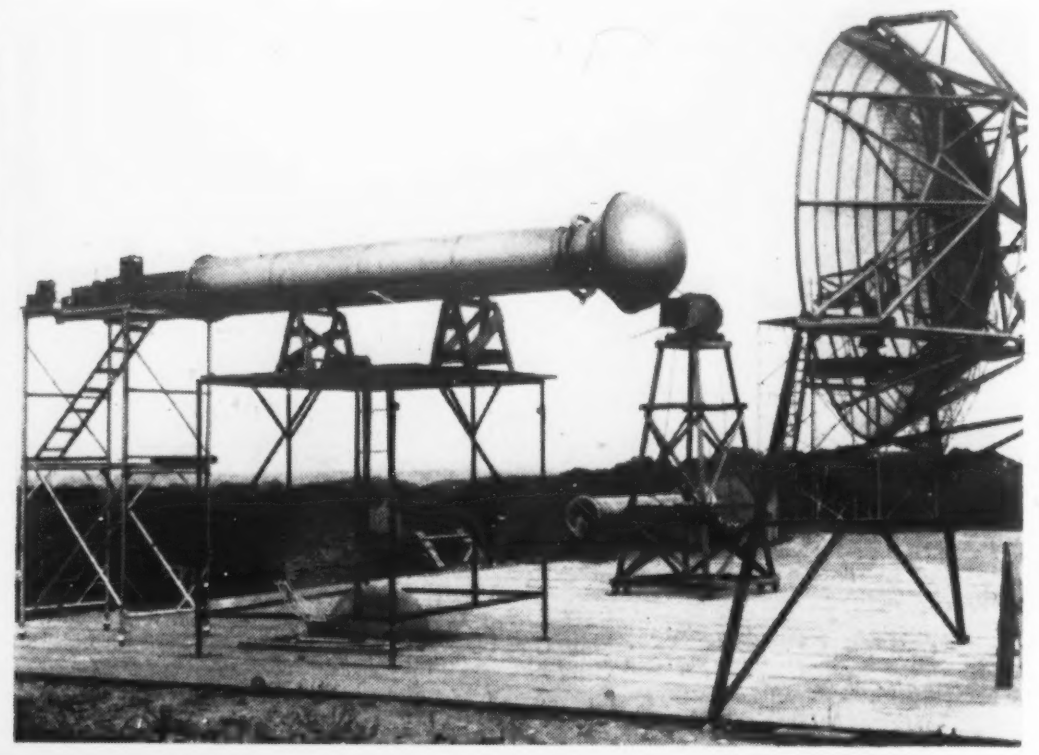
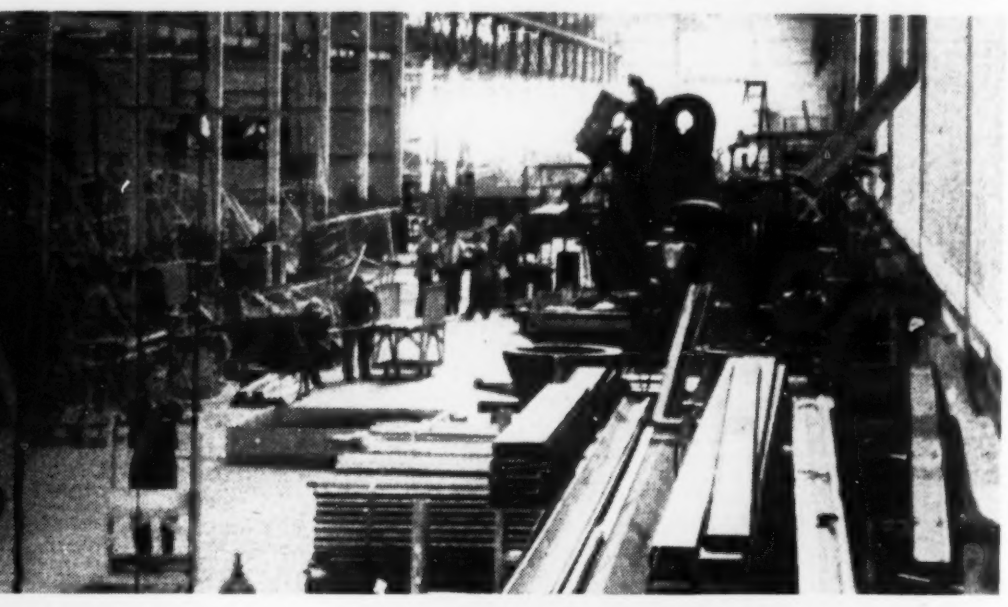
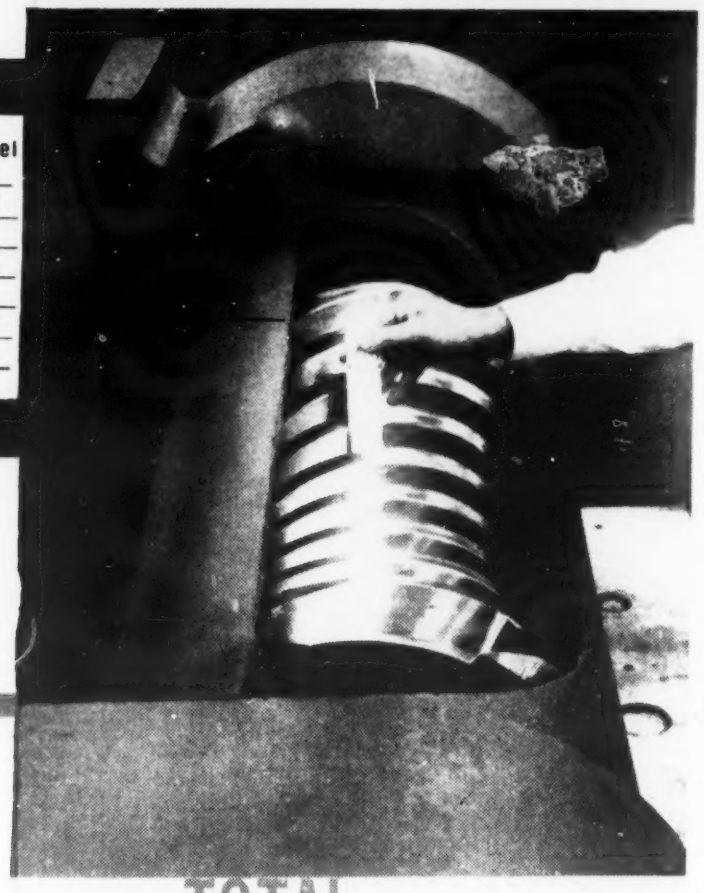
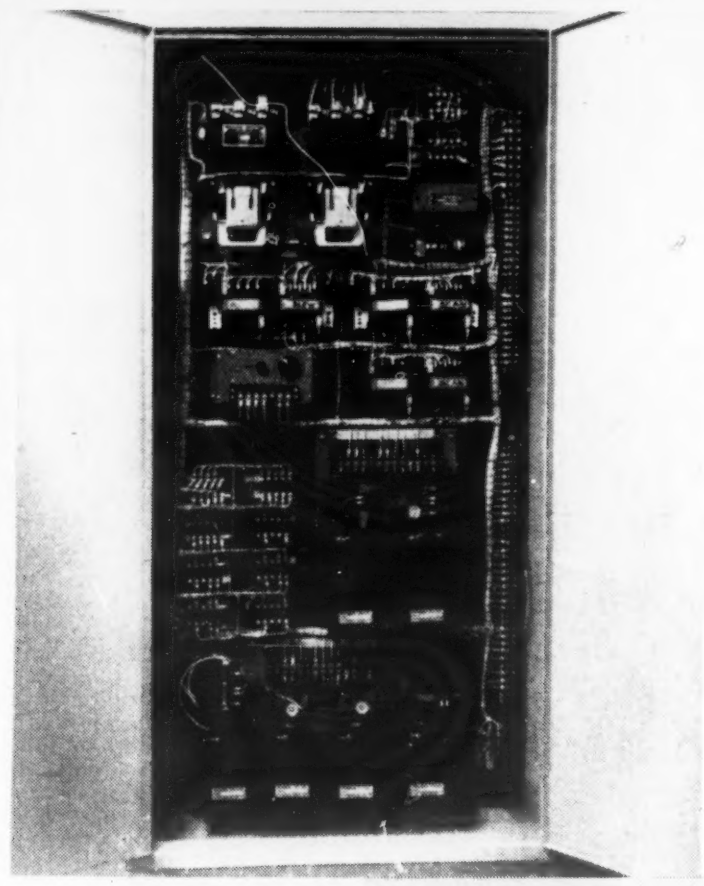


In antenna systems

KENNEDY capability is total capability







TOTAL *capability in the field of antenna systems?*

It's the capability to do the basic R & D in microwave propagation . . . to design and develop the antenna system . . . to manufacture the dish, the mount, and all waveguide components, horns, etc. . . . to provide complete field engineering service which includes site surveying, construction and erection, final checkout, and servicing.

In short, it's the capability *to do it all—a total* service from a single source.

ANTENNA EQUIPMENT

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COHASSET, MASSACHUSETTS EVergreen 3-1200

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P. O. Box 1711, Monterey, California — FRontier 3-2461

Down-to-earth SOLUTIONS *to out-of-this-world* PROBLEMS
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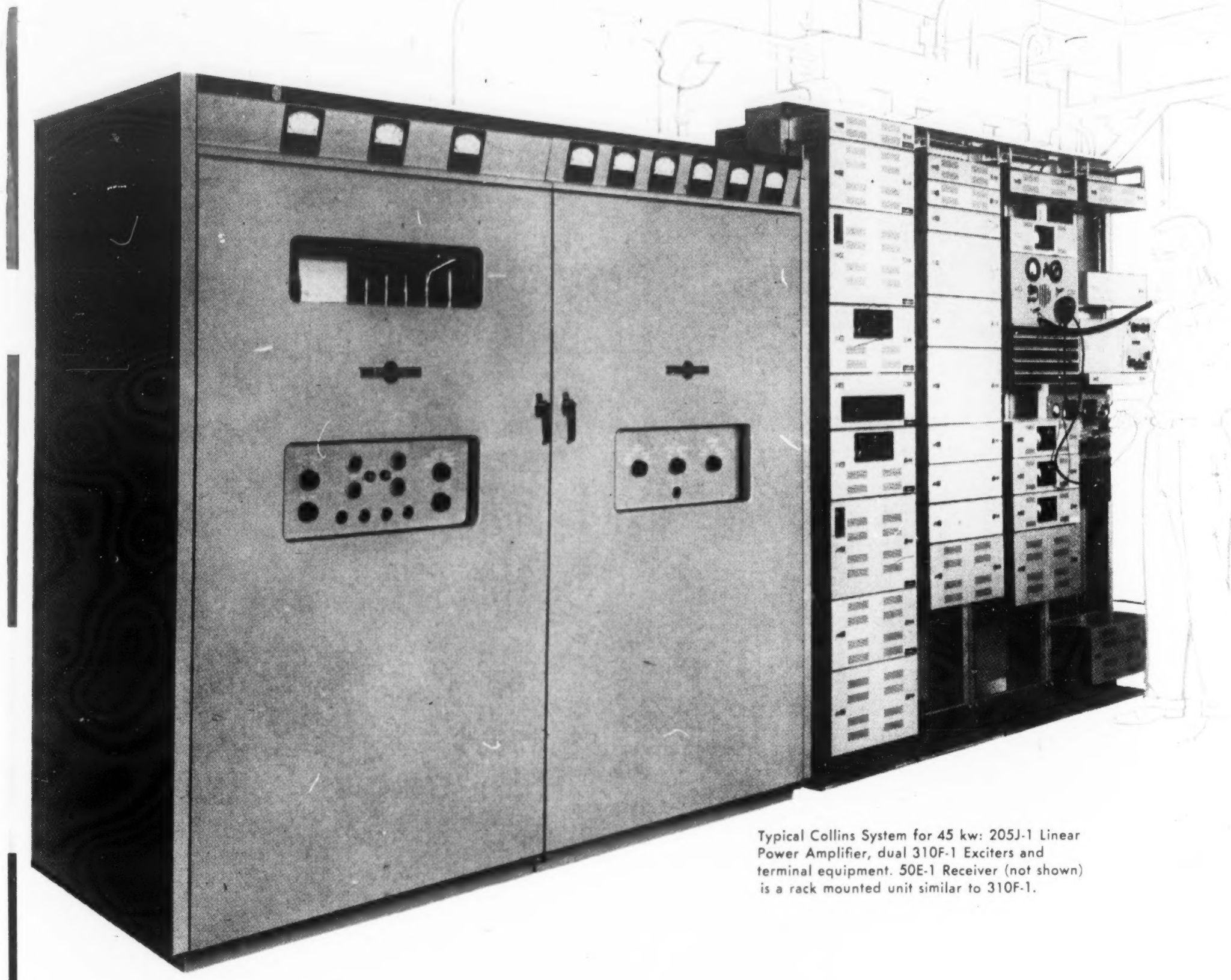

Typical Collins System for 45 kw: 205J-1 Linear Power Amplifier, dual 310F-1 Exciters and terminal equipment. 50E-1 Receiver (not shown) is a rack mounted unit similar to 310F-1.

automatic tuning
for 45 kw
communication
stations

COLLINS SSB

Stemming from a common heritage of design concepts and engineering standards, Collins single sideband systems range in function from low power, fixed tuned facilities to this automatic 45 kw station. Any frequency in 1 kc steps in the 2 to 29.999 mc range may be selected on a direct reading counter dial. Switching matrices enable local or remote selection of antennas as well.

Nucleus for this station is the 205J-1, a fully automatic 45 kw PEP linear power amplifier. Tuning is completed automatically by servo systems actuated by an error signal derived from phase comparison of input and output signals.

The automatically tuned 310F-1 Exciter generates the sideband signal with a balanced modulator and Mechanical Filter, heterodynes it to the operating frequency and amplifies it to the desired excitation level, using receiving type tubes throughout.

Closely related to the exciter is the 50E-1 Receiver. It uses a Mechanical Filter for narrow bandwidth and sharp skirt attenuation. Frequencies are synthesized by a stabilized master oscillator which is phase locked to an internal frequency standard imparting a stability of 1 part in 10^6 per month. Frequency standards with a stability of 1 part in 10^7 per day are available.

The equipment described is part of the complete Collins line of SSB equipment and accessories. Other equipment can provide from 100 watts to 45 kilowatts output with manual or automatic servo tuning.

Write for literature or consult your Collins representative for additional technical information.

COLLINS

COLLINS RADIO COMPANY • CEDAR RAPIDS, IOWA • DALLAS, TEXAS • BURBANK, CALIFORNIA

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SIGNAL is published monthly by the Armed Forces Communications and Electronics Association at 1624 Eye St., N. W., Washington 6, D. C. Second class postage paid at Washington, D. C., and at additional mailing offices.

Subscription rate to members of the AFCEA: 1 year (12 issues), $5.00. To non-members, $7.00. To foreign post offices, $8.00. Single copies, $1.00 each. All rights reserved. Copyright 1959 by Armed Forces Communications and Electronics Association. Reproduction in whole or in part prohibited except by permission of the publisher. Printed in U.S.A. by Monumental Printing Co. at Baltimore, Md. The publisher assumes no responsibility for return of unsolicited manuscripts or art. When sending change of address, please list the old and the new address, and allow 3 weeks for delivery of first copy.

BPA

SIGNAL

Communications-Electronics-Photography

Journal of the Armed Forces Communications and Electronics Association

VOLUME XIV SEPTEMBER 1959 NUMBER 1

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Cover

SIGNAL's cover picture, courtesy of USA Engineer Research and Development Labs., portrays a combination of the Army's new M-60 machine gun and infrared sight—a 24-hour weapon of accuracy.

SIGNAL has carried many articles on IR in past issues. The story on page 44 introduces new applications in the infrared field. Having learned of the special issue on infrared to be published by IRE in September, we deleted two additional IR articles and recommend this issue of the Proceedings of the IRE *as a must on your reading list—it should be a natural.*

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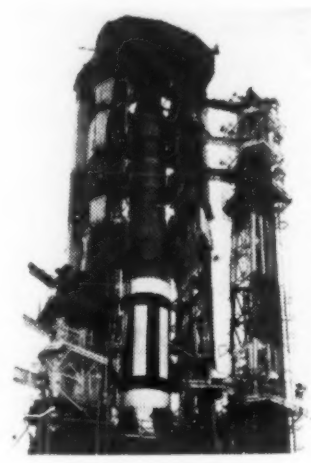
electronics in the aerospace age



by
COLONEL CARLO R. TOSTI, USAF
Chief
Command Presentations
Air Research and
Development Command

(above) Douglas Thor in flight. (upper left) Air Force Titan ICBM prior to launching. (lower left) Douglas Thor prelaunch activities.

TODAY WE LIVE in an age of ages. Since World War II we have variously referred to our times as the atomic age, the nuclear age, the jet age, the missile age, and more recently, the space age. And many, as I do in my title, often refer to it as the aerospace age. Whatever else this age in which we live may be, it is also an electronics age.

The past twenty years and, in particular the past decade, have seen electronics expand phenomenally the capabilities of industry, business and the armed services to produce and to operate effectively and efficiently. Even the individual has profited in comfort and pleasure by invisible hearing aids, television and other luxury-necessities. In fact, within the past several weeks I read in the *Wall Street Journal* about a research and development project by a leading appliance manufacturer which offers the prospect that someday we may see a housewife who is downtown shopping reach into her handbag to adjust a knob—a remote control to adjust the heat on the roast in her oven at home. While this is a future possibility, other fabulous capabilities through electronics have been with us for some time.

For example, since just prior to World War II our eyes which can see but several miles in searching the skies have been augmented by radar which can look out hundreds of miles, and now, with recent developments, thousands of miles to detect objects in space. Through electronic means, light can be amplified so that we can virtually see in the dark. Through the medium of television, we here in Washington can at this moment be witnesses to events taking place across the country. In fact, it may not be too many years before we can, by using satellites as relay stations, sit at home and see what is going on anywhere in the world.

Where human muscles, brainpower and sensory perception have not been adequate for the job of operating swift moving and complex equipments such as modern aircraft, weapon control systems, production lines and so forth, the electronics black box has complemented or substituted as a sensor and a reactor to various stimuli, with a sensitivity and infallibility difficult to match by humans.

Where the operational problem has become so complex with myriad inputs that the human brain finds it impossible to assimilate, store and take action on all of the information available, the electronic brain has taken over. For example, the electronic computer is the heart of SAGE, the Semi-Automatic Ground Environment. The electronic computer also is making valuable contributions by extracting more scientific and technical products from our limited technical manpower resources by solving problems many times more swiftly than they could be solved by slide-rule methods.

Another area in which the computer will make remarkable contributions in the years ahead is in the direct translation of scientific papers from one language into another. The Air Force is quite interested in this capability and is actively supporting the development of such equipment. We're not alone, however, for in a recent article a Russian scientist stated that they too are working on such a computer to translate scientific papers written in English into Russian.

Turning to the vital area of communications, where the human voice is too weak to carry a message more than a few feet, radio communications have made possible global conversations. And here again, as we look to the future, communication satellites promise to simplify and expedite global communications.

Truly, when we summarize and recap the developments

of the past decade we must marvel at what our electronics industry has accomplished. And when we give praise to the fantastic capabilities of our electronics equipment—the computers, the radars, the communication sets, the television sets, etc,—we cannot help but give greater praise to the men of the electronics industry who have created the capabilities demonstrated by the equipment they have produced.

Over the years, their goal has been one of trying to obtain greater capability and reliability with equipment which weighs less and occupies less space. The fruits of these endeavors are seen in some of the miniaturized equipments which are in everyday use today. In the commercial radio field, the small transistorized radio has been on the store shelves for a long time. And already, in the same field, the solar powered radio has been introduced—the transistorized radio which is operated with solar cells which convert the light of the sun into electrical energy.

True, the transistor and the printed circuit have contributed importantly in miniaturizing electronics components and systems. But today, order of magnitude reductions in size are in promise through molecular electronics—a major dramatic step forward, or breakthrough. Perhaps some of you are already at work in this field which has promise not only of orders of magnitude reduction of size but also of increase of reliability. The principle involved in molecular electronics is one of eliminating individual components such as tubes, resistors, capacitors and coils, and replacing them with a piece of material—a piece of material which combines all the functions of the circuit. Westinghouse Corporation, for example, has demonstrated an optical telemetry circuit which consisted of 18 components of the conventional type and 16 soldered joints—each soldered joint, as you know, being a source of potential failure and reduction of reliability. This same circuit, reproduced through molecular electronics, is a piece of material having but two soldered joints—the input and the output—and is much smaller in size. One way of describing the reduction in size is to say that a chassis the size of a breadbox has been replaced by a chunk of material about the size of a cube of sugar. And so we see that there are still remarkable advancements to be made in the electronics field.

As we look to the future, the role of electronics promises to become increasingly important. A Ballistic Missile Early Warning System (BMEWS) is now being constructed in the far north. With this system, we hope to achieve 15 minutes of warning essential in launching our own retaliatory offense and in initiating civil defense procedures. I have already mentioned the communication satellites which are in the future. With these satellites we hope to improve the speed of global communications. The satellite will contribute significantly to the development of a positive deterrent capability by using infrared detectors to pick up the launching of ballistic missiles as they leave launching pads in enemy territory. In short, electronics underlie all of our research and development projects and programs and, therefore, it might be well to review briefly the characteristics of the Air Force of the future and some of the weapon systems of which it will be composed.

From our work of the past, we have today as the backbone of our deterrent force the B-52—a 600-mile-per-hour bomber that can reach any point on the globe, particularly when employed in combination with the KC-135, the all-jet tanker. As we look to the future, the capability of the B-52 will be augmented by weapon systems of much greater performance. Some of these weapon systems will be manned. An example is the B-58 which flies at Mach 2, over 1300 miles per hour. Another follow-on in the bomber class still several years away will be the B-70, or the Valkyrie, being built by North American. This bomber will have a performance of 2000 miles per hour over its entire intercontinental range. With such highly complex weapon systems in our development and test programs, we will have an increasingly critical problem of navigation, aircraft defense, electronic countermeasures, weapons delivery and bomb damage assessment. These requirements will be met through electronic components, devices and sub-systems which those in the industry are developing.

In the field of air defense, we have already in operational use the F-102—a manned, all-weather interceptor in the 800 mile-per-hour class. This performance will be out-stripped in the near future with the introduction into the inventory of the F-106, now completing its flight testing in our command. This airplane will employ air-to-air guided missiles and will have a speed of over 1300 miles per hour in carrying out its all-weather, air defense role.

Beyond the F-106, is the manned interceptor of the future, the F-108. This, also, will be a 2000 mile-per-hour airplane being developed by North American.

Although I have mentioned only our work with manned aircraft so far, I'm sure that you are quite aware of the fact that since 1947 guided missile development has been assuming an increasingly greater proportion of the Air Force program. Some of these guided missiles will complement the manned weapon system in its operational role. For example, the Bomarc, working in combination with such aircraft as the F-102, F-106, and the F-108 is designed to reach out more than 400 miles in the air defense role to destroy incoming enemy bombers of the Bison, Bear, and Badger types.

Other missiles will be used as a part of the manned-weapon system. Examples of these are the air-to-air missiles like the Falcons and the Sidewinders which greatly increase the operational capability of air defense interceptors.

For many years, we have been developing missiles for the tactical anl strategic air roles. The Matador is a tactical missile that has been in operational use in Europe for several years and is now being replaced with the Mace, an improved model which, with either automatic radar map matching or inertial guidance, is capable of penetrating long distances at speeds of about 650 miles per hour to deliver nuclear warheads on tactical targets. Coming into operational use later this year will be the first of our intercontinental missiles. This is the Snark, a subsonic aerodynamic type of missile which has a range of up to 6300 miles (5500 nautical miles).

While the missiles in or nearing operational use are primarily the products of research and development begun in 1947, recent years have brought us to the conception and development testing of more advanced missiles; for example, the Hound Dog, which is a missile to be used in combination with the B-52. The B-52G will carry one Hound Dog under each wing. This will give the B-52G the capability of standing off roughly 500 miles from an enemy target and having its missiles go in at high supersonic speeds to deliver nuclear warheads on important military objectives. While this type of missile will greatly increase the offensive capability of the B-52's we are looking even further into the future and now visualize the development of air launched ballistic missiles of very high speed and long range.

The highest priority program in ARDC for the past five years has been the ICBM and IRBM program. This program has made tremendous strides. Already the first operational Thor Intermediate Range Ballistic Missile

(*Continued on page* 37)

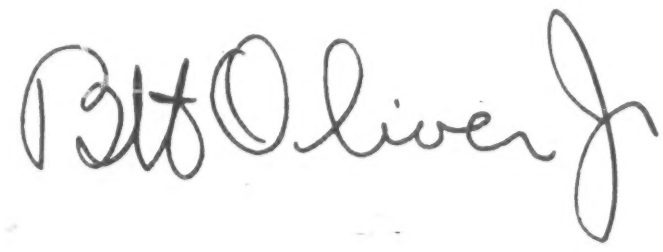
BENJAMIN H. OLIVER, JR.

Vice President, Upstate
New York Telephone Co.
National President, AFCEA

Although I have been connected with AFCEA since its formation, it has not been my good fortune to meet all of the many fine people who give life and breath to our organization. Of course this present assignment of mine, that you have honored me with, will enlarge my opportunity to know many more. However, the limitations of time and space will prevent me from meeting and getting to know everyone with whom I would and should be acquainted. There are so many of you whose genuine interest and ability make our forty-seven chapters function and provide worthwhile liaison between military and civilian communicators!

Consequently, these words of greeting are directed to all of you, to those I now know, to those whom I will have the good fortune of meeting, and most certainly to those with whom it will not be my privilege to become acquainted. This greeting enables me to extend my thanks and appreciation to all you many people who have done so much.

As the months go by I hope you will feel free to enlist the services of our fine headquarters staff, under the competent direction of Colonel Baird, whenever it seems desirable to do so. Furthermore, I trust you will feel that I personally am accessible to you for those matters requiring my attention.



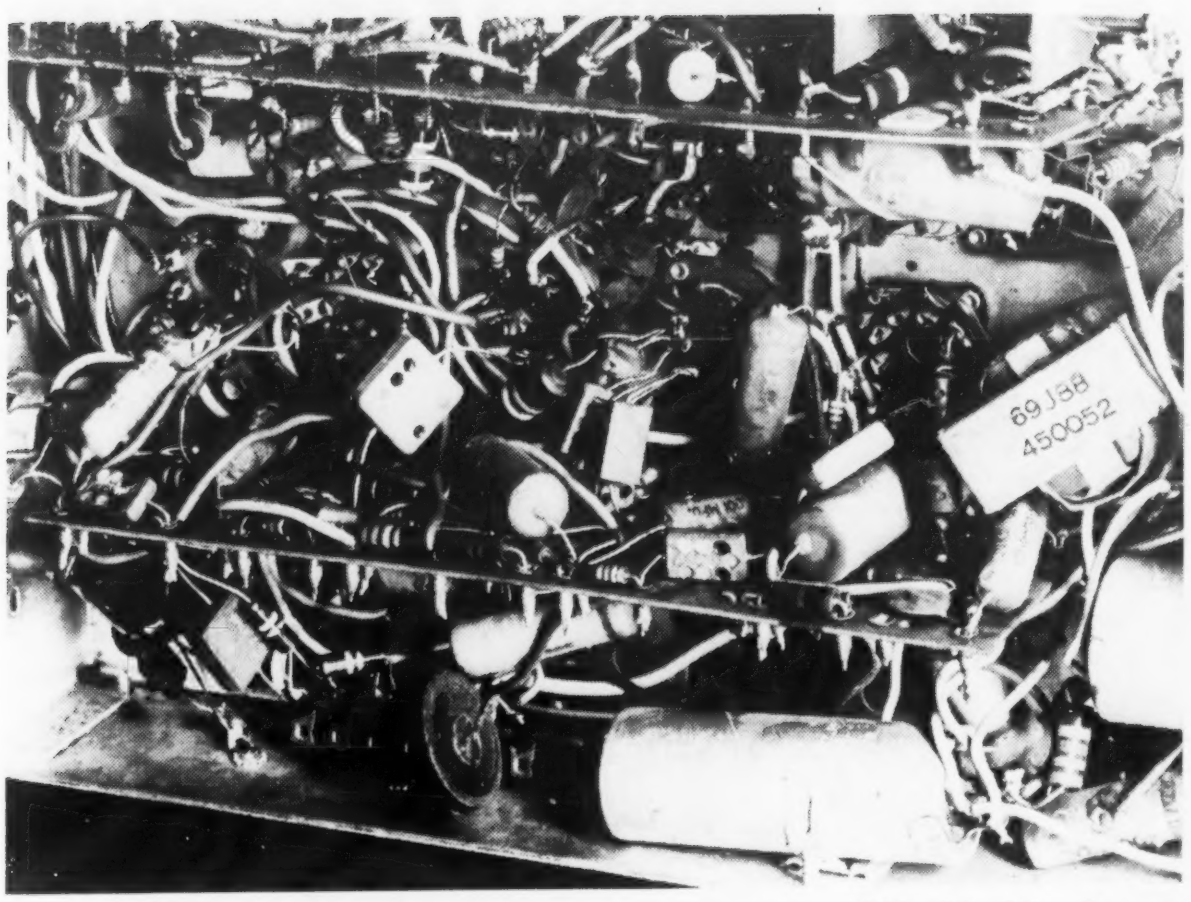


Fig. 1. Early dip-soldered component board used in 1950 GE TV. Step to printed circuitry was logical development.

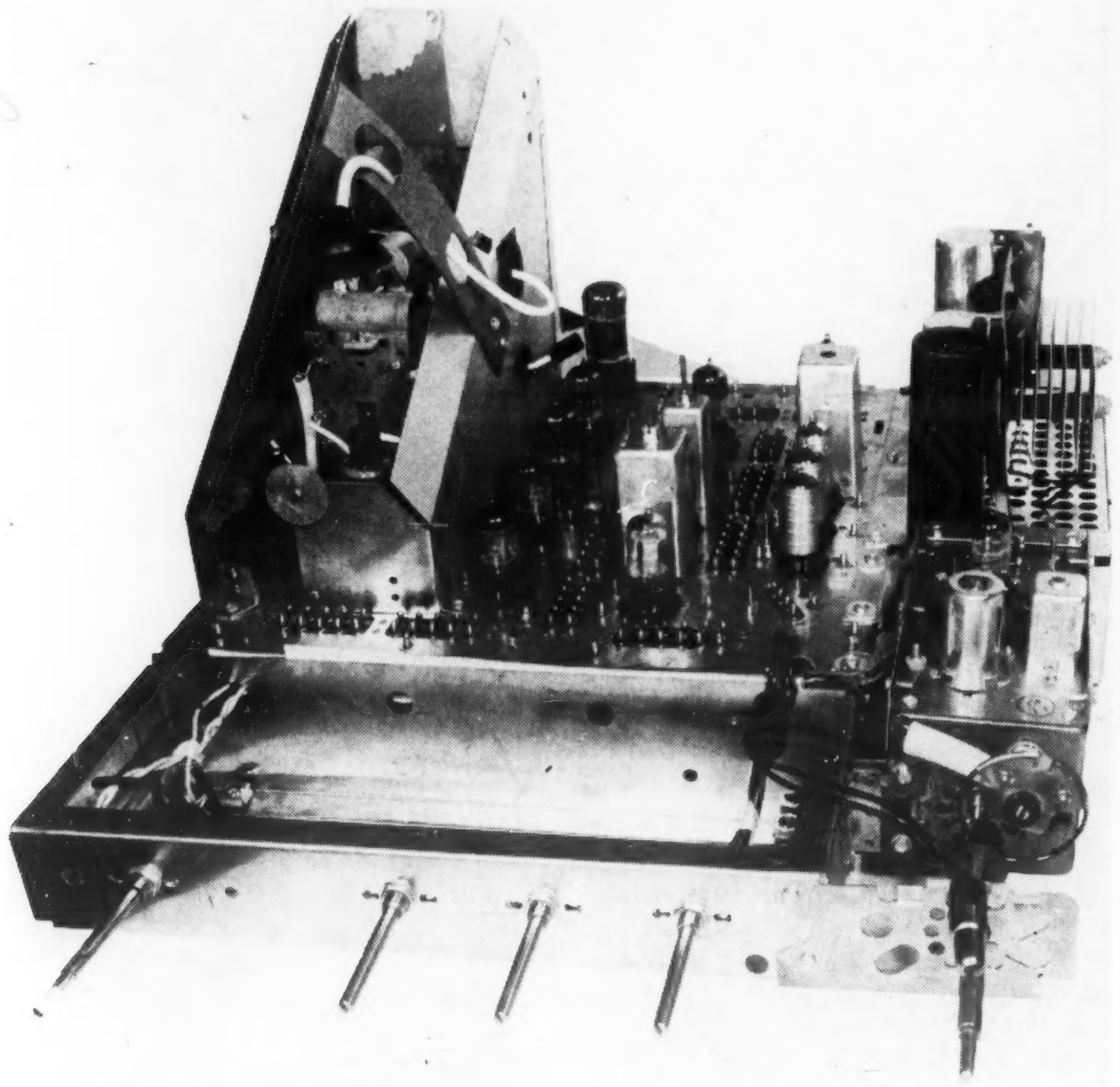


Fig. 2. Dip-soldered TV chassis produced by General Electric in 1952.

PRINTED CIRCUITRY

a net gain for the consumer and serviceman

by S. R. Mihalic, Manager, Product Service
Appliance and Television Receiver Division
Television Receiver Department
General Electric Company

IS PRINTED CIRCUITRY a desirable method of electronic construction? The answer must be affirmative since it is used by *every* major manufacturer somewhere in their radio and television products. I would like to set forth the highlights of printed circuitry, particularly with respect to its value in television receiver use.

Unfortunately, the phrase "printed circuitry" has gained acceptance in industry vernacular. We all recognize, I am sure, that present-day construction is not "printed." Rather, copper sheet is laminated to phenolic resin boards, and an etching process

is used to remove unwanted copper, leaving behind sheet copper which is solidly bonded to a board in the desired pattern. The board is merely a vehicle for the dip-solder process whereby mass soldering of connections in one plane takes place.

Hand soldered connections have always been troublesome from a quality control standpoint because the factors of time and temperature are subject to the diligence or lack of it by individual operators. The search for a better soldering method was stimulated by two needs: 1. Better and more uniform quality. 2. Reduction of labor cost content.

Dip-soldering provides an effective answer to both needs, because all connections on the board are soldered simultaneously, and the time and temperature of both the solder and flux applications are automatically controlled. Our line inspection records prove that our dip-soldered connections are seven times freer of solder connection problems than are hand-soldered connections; thus our quality is better, and our costs lower.

The step from a dip-soldered television chassis such as the "E" chassis produced in 1952 (Fig. 2) to printed circuit boards was a natural one. Here the goal was to compact the chassis circuitry so that a small, lightweight portable television receiver could be introduced. Portable television receivers produced in 1955 were a shot in the arm to the television industry. Printed circuitry permitted compact design. So, the goal had high commercial value.

We would do well to consider the several design criteria which have been developed in connection with quality production of printed circuit boards. Solderability has been enhanced by:

- Proper ratio of hole size to component lead size. A precise ratio has been found that assures maximum mechanical and electrical strength.
- Solder masking. A narrow conductor is desirable for good solder build-up, but a wide conductor provides better strength and adhesion. Silk-screening a solder mask over a wide copper pattern to leave a narrow ring of exposed copper neatly meets both requirements.
- Eutectic solder. A solder which goes directly from the liquid to the solid state without going through an intermediate mushy stage greatly reduces solid solder joint incidence. Such a solder is eutectic, and is used in our production.

The combination of our experience with dip-soldering techniques, and the development of sound printed circuit design criteria has made possible a large improvement in over-all receiver quality. Our measure of quality is in terms of average minutes of service time required during a given period of consumer use. The data comes from analysis of service tickets from several locations throughout the country. RAMAC is used to produce regular quantitative quality reports based on service tickets. These reports have established that our quality level has improved more than 100%! And the comparison is with receivers which were considered to have very acceptable quality only a few years ago. In addition, our data indicates that printed circuit defects are a tiny fraction of the total service time required.

Improved quality is just one of the advantages afforded by printed circuitry. The precise uniformity of printed circuitry has important advantages which cannot be duplicated by hand-wired construction. Since every component and conductor on the board has exactly the same location regardless of the hundreds of thousands of boards that may be made, distributed capacity is virtually a constant. This means that circuit design can be better optimized, with the result that the product has much less variation from design level. Average performance is higher, with less spread between the high and low limits, and with more stability. Line operators find it easier to check their own work, and easier to learn. New designs going into production come up to line rate as much as six weeks faster than was the case when our receivers were hand wired. These two facts mean that fewer errors occur and much less rework is needed so there is less cost and higher quality in printed circuitry.

There has been a good deal of controversy generated within the industry over the use of printed circuitry. In my opinion, it is a result of resourceful advertising rather than the product of conflicting evaluation. Moreover, I believe that the public depends primarily upon television servicemen for advice in such matters, and servicemen are changing their opinion of printed circuitry. I can well appreciate the complexity faced by servicemen in keeping abreast of the designs of all television makers, and can understand why they have tended to oppose large design shifts. Printed circuitry complicated the circuit tracing process, and early boards introduced a new variety of difficulty in handling problems, such as hairline conductor cracks and intermittents. It is no wonder that servicemen were inclined toward a dim view of printed circuitry.*

But their view is changing. The quality improvements described earlier are now apparent in the field. Servicemen are better acquainted with printed circuitry, and have assimilated printed circuit servicing techniques. The chief complaint of servicemen really was the lack of accessibility associated with early printed circuit models, particularly in portables. Eighteen months ago, General Electric Co. introduced its "Designer" series which was designed for high serviceability. It was the first large-scale evidence that manufacturers appreciated the accessibility problems of servicemen and were doing something to alleviate them. With the back of the Designer removed, the serviceman has access to both sides of the "Printed Circuitry." (General Electric's name for it is Precision Etched Circuitry.) Except for a few items, such as the tuner, the serviceman can trouble-shoot and correct right in the customer's home all the problems normally encountered, and he need remove only the back to gain access. The Designer also permits isolation of B+ branches by the removal of a wire from a wire-wrap terminal, which greatly facilitates the isolation of B+ shorts.

In all models of General Electric's 1960 line, the serviceability features of the Designer are incorporated. Also, the 1960-line boards have printed on the component side a line drawing of the circuit to simplify circuit tracing. General Electric boards have components on one side only.

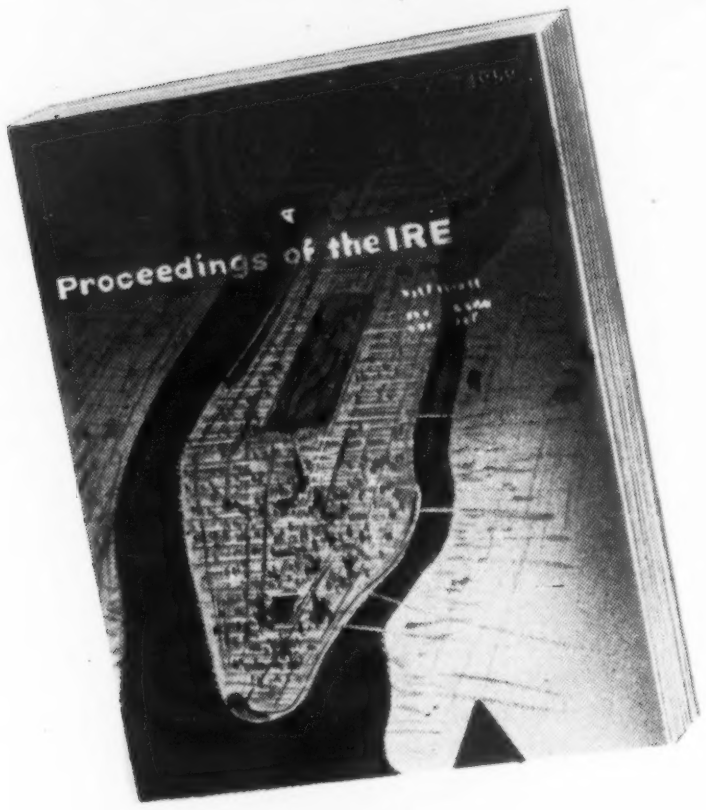
The impact of better quality and serviceability, which result from printed circuitry use, benefit consumer and serviceman alike. Also, manufacturers are better able to produce designs which continually reflect the rapidly changing technology of the industry. These are the means by which the industry offers better television products. In closing, I submit a final measure of the industry's progress.--Television today stands at 70.2 on the U. S. Department of Labor's wholesale price index (1947-1949 equals 100) while motor vehicles are at 143.2 and major appliances at 105. Progress is indeed a most important product.

**(Editor's Note: See "The Serviceman and Printed Circuits," by D. H. Kunsman in the June issue for a more detailed account of this point.)*

As Comprehensive A Review of

INFRARED

as Security Restrictions Will Allow!



The turning point in the practical application of infrared to military problems was during World War II when the Allies discovered the German Army was using infrared for secret signaling between infantry troops, for the surveillance of Russian tanks supposedly secure in the darkness, and for the detection of Allied night bombers which confused radars by the use of chaff. The turning point for the commercial application of infrared came about the same time when the American synthetic rubber program required rapid analysis of the C_4 fraction in butadiene production. Since this could best be achieved through infrared spectroscopy, commercial infrared spectrophotometers for chemical analysis began to appear in 1943.

Today, despite great advancements in the application of infrared to military and commercial uses, it appears to be only on the threshold of its full realization. That's what makes infrared such an exciting and challenging topic to investigate.

SEPTEMBER PROCEEDINGS OF THE IRE EXPLORES ENTIRE INFRARED FIELD

This special INFRARED ISSUE of the Proceedings of the IRE is the first unclassified American publication to bring together in one place the bulk of the basic information on infrared physics and technology. The material is current, authentic, and much of it recently declassified. It was prepared under the auspices of the Infrared Information Symposia (IRIS), an organization sponsored by the office of Naval Research and under joint-service direction.

This comprehensive review of a rapidly growing science—infrared—is only one of the many services offered members of the IRE. Non-members of the Institute of Radio Engineers, however, are invited to reserve a copy of this vital issue by returning the coupon below, today.

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THE INSTITUTE OF RADIO ENGINEERS
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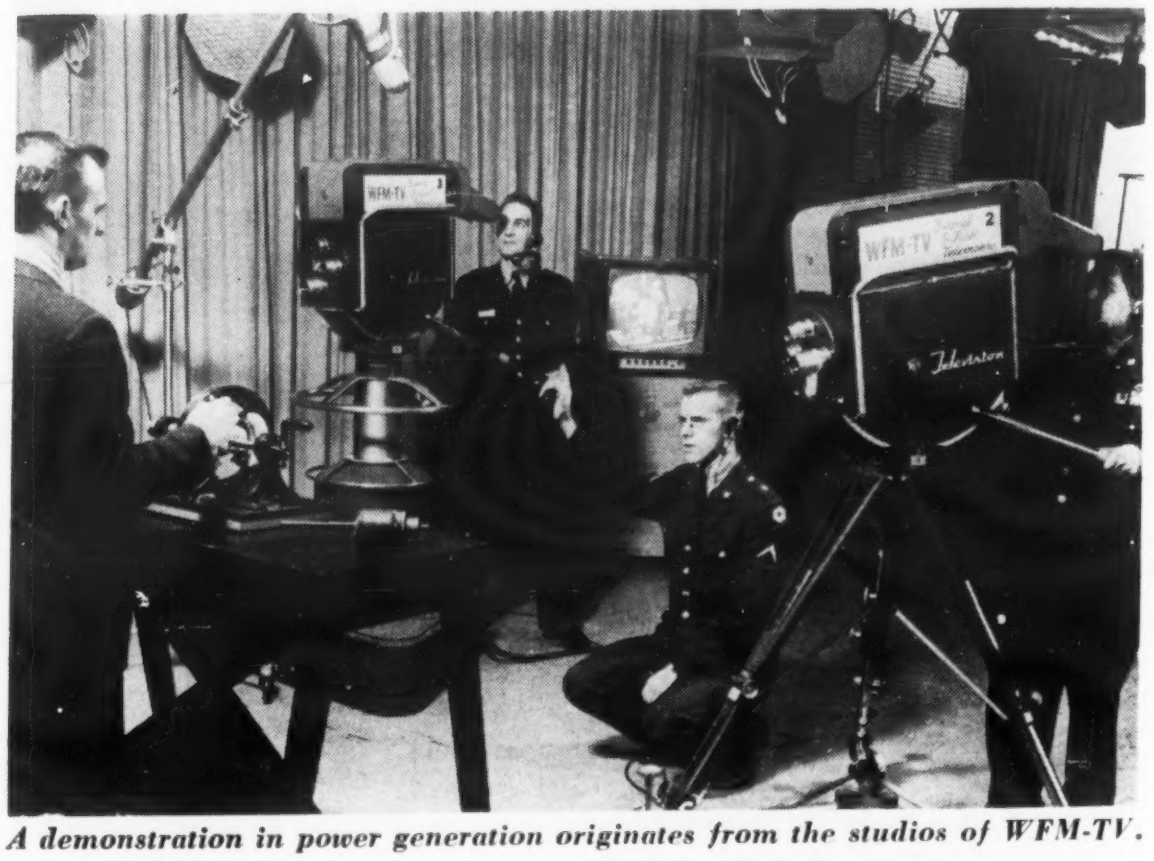
signal school

TV comes of age

by Col. A. L. BURKE, Director
Dept. of Specialist Training
US Army Signal School
Fort Monmouth, N.J.



A demonstration in power generation originates from the studios of WFM-TV.

On February 6, 1959, Brigadier General (now Major General) A. F. Cassevant, Commanding General, Fort Monmouth, N. J., accepted from the contractors and officially placed in operation at the U. S. Army Signal School, one of the largest and finest closed-circuit educational television systems in the world. Present for the acceptance ceremony were representatives of the Radio Corporation of America which installed the new studio equipment, and of the Jerrold Corporation which engineered and constructed the distribution system.

This ceremony marked but a step in the use of television for education in the Army Signal School—not the beginning, for the system placed in operation recently is a renovated and greatly expanded one, not a new one. In fact, the school embarked on a program of educational television in June, 1951 when it acquired a single television camera chain from an Army Signal Corps exhibit and installed it in a combination studio-control room.

In succeeding years many experiments were conducted to determine the extent to which television could be used as an aid in presenting the various technical subjects taught in the school. Findings from these experiments led to a gradual expansion of the physical television plant and to an enlargement of the program of teaching by television. By late 1957, School authorities were convinced that television could be used to increase training efficiency, and in certain areas actually would reduce training time. Accordingly, authority was requested and obtained to modernize both the studio and the distribution system, and to expand the outside plant to provide outlets in all classrooms. Thus, the ceremony referred to above signified the belief of the Signal School that educational television has come of age.

The new facility comprises a seven-channel system which feeds 468 receivers in classrooms, five large area projectors in theaters and assembly halls, and thirty-five receivers in the Post hospital. All outlets are on cables except the large screen projector in the auditorium of the U. S. Army Signal Research and Development Laboratory, which is fed from the studio by means of a microwave link. Total length of the distribution cable is about ten miles, and it contains thirty-two distribution amplifiers. Thus, the system allows up to seven simultaneous programs and accommodates up to 10,000 viewers of a single program.

The live studio contains three image orthicon camera chains of the latest type, a video switching system, a telecue prompter and other auxiliary equipment. The film studio has six vidicon film chains, a light multiplexer, one TV-adapted 16mm film projector, a 35mm automatic slide projector and other miscellaneous equipment. The principal equipment in the recording studio is a kinescope recorder. A rehearsal studio is equipped with two field-type image orthicon camera chains and an audio console. The portable image orthicon chains can be removed from the studio and used for outside shots to be fed into the studio over a microwave link.

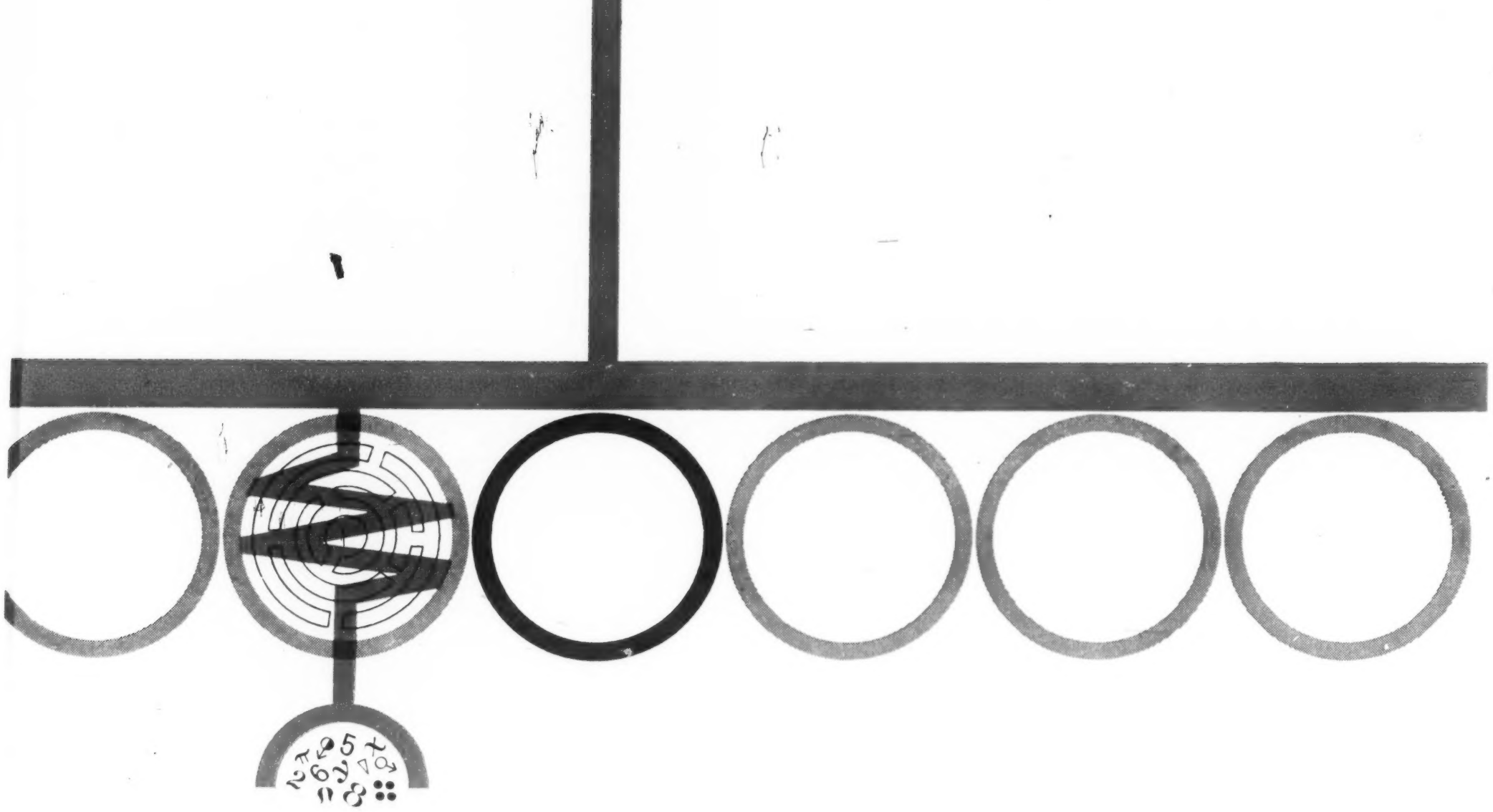
Distribution is effected through the Master Control and Distribution Center which contains two sync generators with automatic changeover facilities, pulse and video equipment to accommodate seven channels, one off-air receiver, seven video automatic gain control amplifiers, seven RF modulators, one master monitor and seven individual channel monitors.

Two additions are planned for the television studio. The first is a set of video tape recorders. This equipment will aid greatly in the instructor training program and also facilitate the making of kinescope films. The second equipment planned is a modern teleprompter which will permit more professional presentations from the live studio.

The entire TV facility described above is operated and maintained by the Television Division of the Army Signal School, except the outside plant which is maintained by the Post Signal Officer. The Television Division consists of four officers, twenty-four enlisted specialists and two contract technical representatives. Instructors for the live programs come from the thirty-three courses being taught by the Department of Specialist Training. A staff position of Television Coordinator has been established recently in the Department of Specialist Training with the mission of coordinating and supervising the employment of educational television throughout the school.

Instructional programs carried by the TV facility are of three types. First, there are the training films required by the various courses in the School. Second, are kinescope recordings covering various areas of instruction, which are made by the Television Division and the academic division primarily concerned. The third category is that of live programs produced by the Television Di-

(*Continued on page* 43)



COMPUTATION ATTUNED TO TEAMWORK

IT TAKES A LOT OF PUSH IN THE RIGHT PLACES TO PUT A PROGRAM INTO SPACE. BURROUGHS CORPORATION CONCENTRATES ON COMPUTATION—EVERY PHASE FROM BASIC RESEARCH THROUGH PRODUCTION TO FIELD SERVICE. APPLY IT TO A TEAM AND THINGS HAPPEN. FOR BURROUGHS CORPORATION HAS THE PROVED COMPETENCE TO MAINTAIN THE INTERFACING RELATIONSHIPS AND INTERTEAM COMMUNICATIONS THAT ACHIEVE SPACE OBJECTIVES COMPATIBLY AND EFFICIENTLY.

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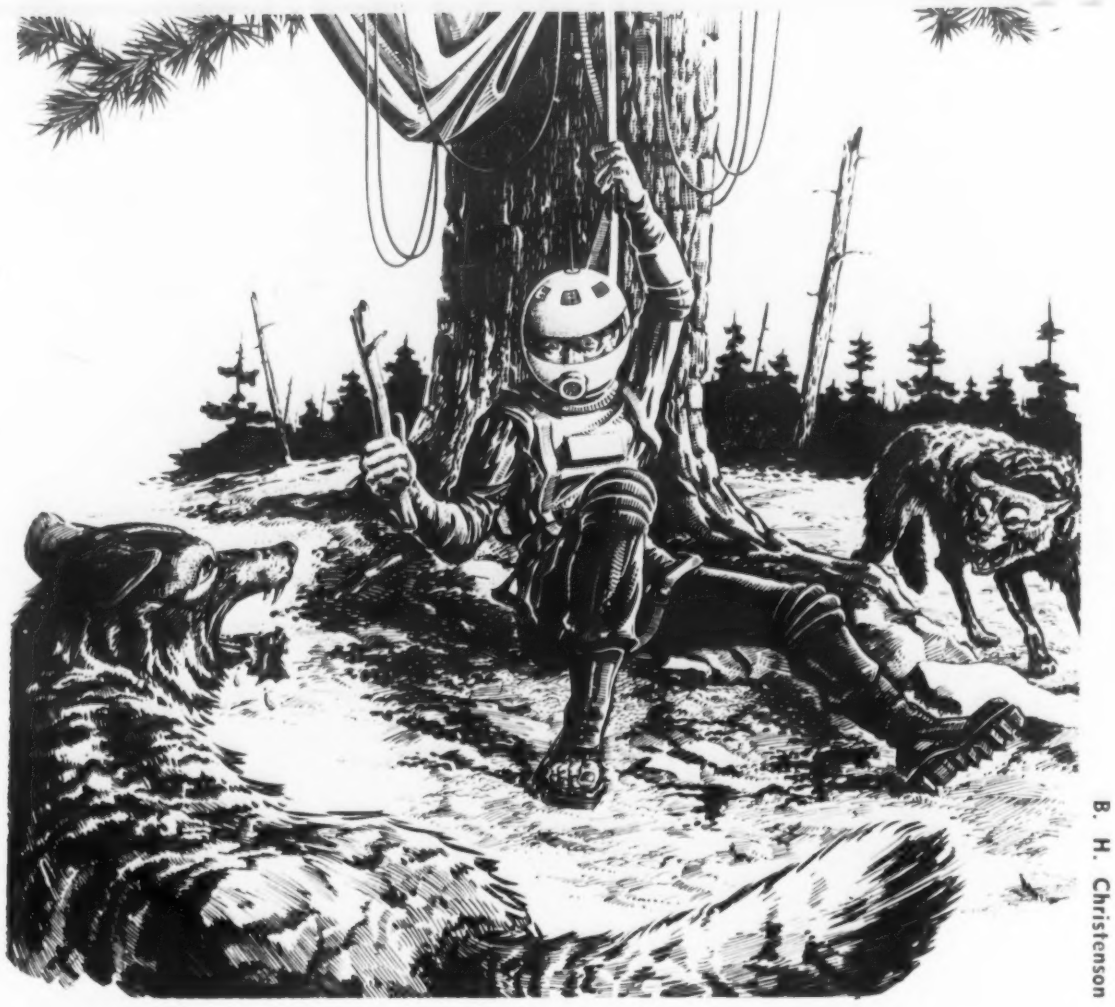

B. H. Christenson

. . . a couple of vicious looking Siberian wolves were seriously testing the thickness of my leather boots.

Upper Acksomania
April 1, 1959

Colonel W. J. Baird, Ret.
Editor, SIGNAL
Washington. D. C.

Dear Sir:

You may have been worrying, perhaps. over why I haven't written for SIGNAL recently; but have you ever been an Astronaut? Do you know about a computer which can think better than men? Do you appreciate how important women *really* are?

Read on . . . . .!

I am writing to you, since through the medium of your learned publication I know I can reach thinking people not afraid to face a horrendous fact of life. Mine is a story which probably should have been transmitted through official security channels to Washington. but those worthy censors might well have regarded this whole thing as somewhat Top Secret and therefore locked it up.

But the American people should and must know!

While SIGNAL readers may have forgotten me. I'm sure you remember I do specialize in telling really big truths. This letter. to the believers of its content. may lift some of the fog obscuring tomorrow's horizon and give comfort to many: and to the disbelieving. let them rot!

But forgive me in my rather uncouth convictions . . .

First let me startle SIGNAL's readers by the simple statement that man's first attempt to put a man on the moon failed. I know that for certain for I was the central figure—a lone passenger as it were. on the world's most important but least publicized rocket misfire. But let me dodge that snafu for a moment and first bring out one other fact.

I now find myself in a delightful northern clime which geographers refer to as the State of Upper Acksomania.

Why am I here?

It is a long story, but shorten it I shall, for many wild, reckless and unprincipled people are now looking for me, and where I am now hiding, paper and pencils are rare; but on with the story—

My departure from the U. S. was quite Top Secret. I was put into a weird space suit contraption—destination Moon. From Canaveral, I blasted forth, riding on the fury of 1,000,000 pounds of thrust, strapped down in a much-cushioned and air-conditioned compartment. My Mach number increased rapidly from 0 toward the velocity of escape. Theoretically. I was programmed to orbit the moon a few times and then make a soft landing, and for twenty-four hours gather scientific data. Then, and in a carefully planned and much-rehearsed take-off. I was to return following the easiest gravitational path. reach the earth four days later, be slowed down by a retro-rocket to 700 miles per hour and automatically be ejected at 65,000 feet in a hermetically sealed container. Barring accidents. after descent first by ribbon parachute. I would then blossom out in a cornucopia chute which was to glide softly into Lake Michigan, joining there a welcoming school of fresh water mermaids. After a Chicago welcome, I was to be escorted to a TV station nearby, where on a coast-to-coast network I would speak and was not to forget my sponsor. I was to emphasize also that the Midwest was in this space-age racket too!

But the whole plan flopped!

I had hardly reached a decent ICBM velocity when the motors conked out and I saw Asia getting bigger and bigger like Ireland in the last few days before St. Patrick. In desperation, I pushed the release button, felt a violent tug, and then blacked out.

When consciousness returned. there I was suspended close to the ground in mountainous country with a big pine tree completely draped by my second parachute while a couple of vicious looking Siberian wolves were seriously testing the thickness of my leather boots.

I released myself and, apparently unhurt, clobbered the wolves with a few convenient rocks. and stumbled down the mountainside looking for signs of civilization—knowing not and caring less, as to where I was, since I was extremely pleased at being alive as you can well imagine. [The wolves had leaped to the brush for apparently I did not qualify for a spot on their menu.]

TOMORROW—*a strange letter from Christopher James*

I soon found people—strange but interesting characters; some even spoke broken English. They accepted me and asked no difficult questions. I thought, almost, they were expecting me and as it turned out later, they were, sort of—

Through maps these congenial people brought me, I discovered that this little country in which I had landed sprawls around the headwaters of the Olga River where many small fresh water torrents combine and race southward, becoming a great river embracing an entire continent, large fractions of which are not particularly known for friendliness toward Westerners.

Peculiarly, as I soon learned, while this little country's mores and languages were quite positively identified with this large and well-known nation, the individuality of Upper Acksomania remained quite distinct. For example, the entire populace seemed to be working on a colossal cost-plus-fixed-fee contract and hence was in a great state of prosperity. Rewards were not measured by output, or "equal pay for equal work," but rather income was based on input. This phenomenon—a delightful summer's dream, of course, is not unheard of even in the hard-working United States, particularly in the fabulous military electronics industry where cost-plus-fixed-fee contracts are very popular with those who have them.

But not to change the subject, this quaint little nation of Upper Acksomania is characterized by the fact that almost its entire male population possesses the equivalent of what we in the U. S. call Ph.D. degrees. Paradoxically, the Acksomanians really have no actual usable long-haired "Doctors of Philosophy," but seem to concentrate on a citizenry who think in terms of biometrics, psychometrics, econometrics and topology. Riding above all these, there are physicists, mathematicians and in the very top strata are strange young beardless characters reverently referred to as computer experts.

Philosophy, it seems they leave to others—

The Acksomanians are a dedicated group. They accepted me as their one and only unscheduled tourist, not even questioning my arrival, the meteoric aspects of which fortunately were unobserved. I cleverly too, registered in their Transient House as Christopher Jameski and made a point to frequently use such expressions as "Da" and "Nyet" and "Comrade." No mention was ever made of money, since everything was provided by the local constabulary which for me was fine and saved much embarrassment.

Since everyone seemed "cleared" their discussions from the first were quite open and frank, but my hair changed from a slick Broadway brush-down to a stand-up Princeton flat-top when I heard them speak of the life to which they were dedicated.

In simple terms, here was the talk of the town: "First," they modestly said, "we shall conquer the prosperous United States by taking possession of all of her physical resources; then second, we shall gradually become richer by outsmarting her present politicians; and third, we shall move into the U. S. leisurely and live a life of comfort based on possession and control—all to be done by peaceful means and, of course, for the general good of everyone."

My first reaction to this Utopian philosophy was simple; it sounded very much like the talk of certain unscrupulous minority organizers with which all United Staters are quite familiar — if they read the newspapers.

But then a thought struck me much like a breath of Antarctic air hitting a true Southerner on his third Mint Julep the afternoon he picked the Derby winner.

These people obviously were only smart contractors knowing a good thing when the all-around choice was not too good. Cooperating too, were their children, who cried for Boolean algebra instead of milk.

Could it be, I thought, that they were intellectuals innocently but enthusiastically contributing to some diabolical plot not of their own origin? Perhaps—

Later, at dinner, over a stein of fresh goat's milk, I couldn't help but overhear this enlightening and very illuminating conversation from an adjacent table:

"Ivan—take the average American, I mean his brain, such as it is. It is composed of many neurons, each capable of holding one elementary piece of information. These cells are built in but unoccupied at birth and total roughly 10 billion per person.

"Now—as these backward capitalistic people grow, this collection of neurons begins to organize — each neuron cell may have as many as 600 different connections to other cells, but how they connect with each other depends on heredity and environment. Thus, much of this neuron organization is left to chance—the capitalists call this free thinking in another cheap attempt to delude the populace. In Upper Acksomania and in our great Motherland, of course, the State shows the way for the interconnecting of these neurons in a very superior way."

"I think I understand, Igor" said an Ivan close by, "You mean as a human begins to grow, this collection of neurons will actually organize so that memory and recognition will follow with the eventual random end-product of reasoning ability coming forth?"

"I mean just that, Ivan," said Igor nursing his Vodka punch and he continued, "As these connections stabilize and become permanent, a man's characteristics emerge. You can say the possible connections far exceed those which could be prescribed by the inheritance genes and on the latter point is where people like us start winning over unenlightened people since we fill the empty connections with Stalin's teachings—genetics be damned."

"It sounds just like a biological computer," replied our Ivan, a scantily-bearded physicist, who had just recently joined the community of Upper Acksomania coming from the southern part of Olgaland where human behavior is completely controlled and not left to chance of any sort.

While all this was going on, I watched a little man out of a corner of my eye, a part of the group, but keeping his silence: a strange warped

(*Continued on page* 15)

Crosley Radar

And . . . . . .

America's defense

Soon the latest in ground radar from Crosley will stand watch along the distant approaches to the North American continent. Since 1955 Crosley's radar engineers have been at work—designing, perfecting, improving this important new radar unit.

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Avco/Crosley

Fog Over Tomorrow

(*Continued from page* 13)

personage who was listening intently, but squirming as though beset by vermin. But finally he spoke up, "Gentlemen, you are not so stupid—but let me tell you more why we are here—Nyet?"

A wave of silence fell—glasses were softly and respectfully placed on the table, for to me it quickly become apparent that this little dwarf-like man, slouching in his chair, drawing on a stubby pipe long gone out, was Petrovsky, the man under whose direction the many Olga River tributaries were being dammed and who himself would direct the use of the million megawatts of power this great project was soon to generate and consume.

"Comrades," he said, "Let me tell you something—you said computers—well computers it is; ten years ago we could build computers which could win over a monkey in tic-tac-toe or checkers. With a ten million ruble machine we were able to make it a good contest between the machine and a low-class human moron. In those early years, however, even if we took twice our electronics industry, plue one-half of the U.S. TVA electrical output and instrumented an area as large as Stalingrad, we could hardly make a machine capable of meeting a high-grade human moron in fair intellectual combat. But why do that? That is a game the depraved democracies are best suited for since they have so many people who qualify for the contest against the machine.

"In our enlightened environment, through superior research, gentlemen, our computer technology has long passed through these elementary stages. No longer do we follow Einstein and say mathematics is the subject in which we never know of what we speak, or whether what we say is true; our machines talk for themselves. We now grapple with the problem of human behavior and today we are on the threshold of making a machine which can reason; tomorrow, and I mean this literally, we shall have a machine which can think and before the next ten months are over, we shall have a machine which can make decisions far better than yours, or mine.

"You mean—" interrupted Ivan.

"Da—and much more, for on tomorrow a big fog will start lifting as gloriously we first turn the generators on and start pushing buttons."

"Take a new state-owned baby with billions of neurons floating about awaiting nature's growth connections or cross correlations as he drains his milk bottle and later eats turnips and potatoes as and when we grow them. It is like the computer we now build. Instead, however, of waiting for stimuli to develop over the years resulting in the gradual build-up of the brain "becoming the person," we study the grown person first, and connect our computer elements to correspond to his previously demonstrated reactions. Once we have programmed our machine in consonance with our selected man's previous responses, we need only query our machine and we know with certainty his potential reactions even though he has never heard the question. For group reactions the same, only a more complex cross-correlation is required as we seek to answer the question."

"You mean—?" interrupted Igor.

"Precisely," continued Petrovsky, "our new computer can be thought of as easily capable of expressing neuron characteristics, such as fatigue, temporal and spatial summation of physical reactions, exhilaration, depression, love, hate and indifference. With current research data, these computers can even be taught to recognize relationship and do deductive or inductive reasoning."

"But Petrovsky," interrupted Ivan, as he slightly tilted a Vodka bottle eliminating the void in his stein, "In the U.S. they have long said — fill Yankee Stadium with electronics, give it all the power of Niagara and the brain power you produce equals not even that of an anti-Dodger fan."

"Right," replied Petrovsky ignoring the impertinent interruption and the libelous remarks against half of the population of the United States, "but remember this—in computers, thanks to our glorious party, new components are coming into being which are extremely small and inexpensive. We can now manipulate tens of billions of storage cells at liquid helium temperatures which reduce the geography from Yankee Stadium to a medium sized CARE box. We must now find out what happens when we put billions of these thought-retentive devices into a complex, stir and see what we come up with."

He continued—"In the U.S., air defense computers and beach radios are built with a technology of 50,000 components per cubic foot—printed circuits, etc. Of course, this sells to many nit-wits. New concepts of miniature micromodules, they say, offer them 500,000 components per cubic foot. Even their moron's competition is now coming down to room size.

"Now, gentlemen, in our project, we have done that a long time ago and much more; in our small box with 50,000,000 elements per cubic foot, we duplicate the average human brain; in a large auditorium we can duplicate even the brain of Stalin; in ten times that size, we build a supermagnificent genius—even bigger than the composite of all the historical greats — who, by the way, has a cigar?"

Quickly seizing a priceless opportunity, I offered my last cheroot.

"Thank you, Doctor." said Petrovsky as he fumbled with a match and also absent-mindedly took over my stein, choking first, and then adding Vodka to overcome his obvious allergy to goat's milk.

"But, by the way, my good man, your clearance?" pleasantly queried Petrovsky, as he puffed on his newly acquired cigar like a small locomotive climbing a large hill.

"Oh," said I, "Clearance—yes, I am happy indeed and honored," and my mind raced for an alibi. Should I tell him I had just dropped in from the stars and some stripes 500 miles up, protected by a magnesium cannister which by my frantic signal automatically ejected me over Upper Acksomania when I failed to escape the earth's gravitational field?

No—the publicity would be in reverse English; and anyway, the conversation was now much too exciting and important; I must prolong it—the U.S. had to learn of this fantastic scheme and I thought of George Washington; could I join him in history, or would one lie matter?

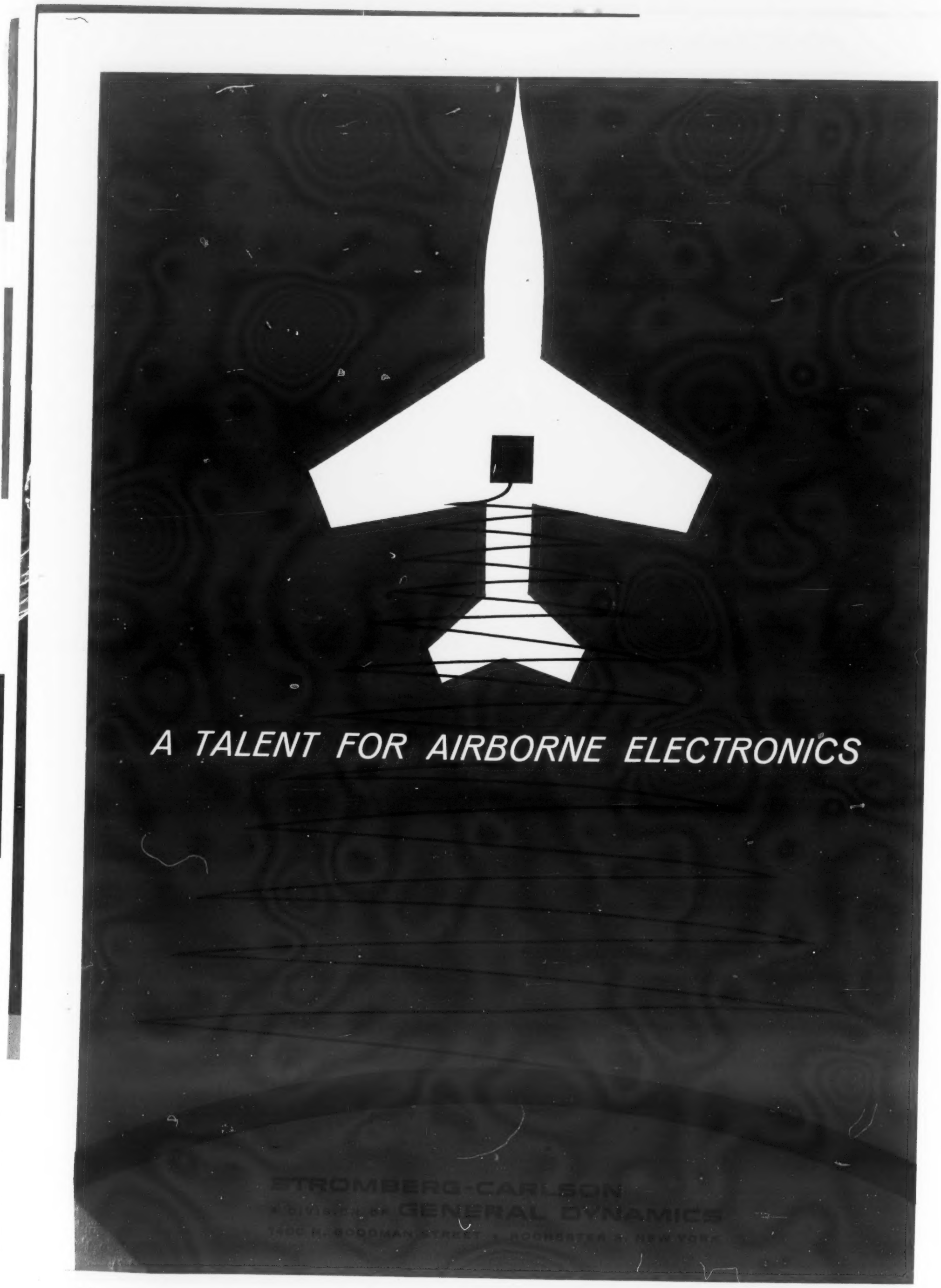
"Comrade Petrovsky," I said, after deep thought, and with a big decision made. "I was sent to help you by an agency which does not wish its agents here known! I am sent as an expert on American people so you can program the giant computer to give Americanized answers before the U.S.ers know the questions. For the safety at least of the most important of us, none of you is to know how I obtained this knowledge!"

He understood my English, better even than in Brooklyn—.

"It is good, you have arrived just in time. Here is our three-point program," replied Petrovsky completely satisfied. To him, security regulations were only a boring necessity since he modestly thought he was so far ahead scientifically no one could ever reach, let alone pass him.

"First," he continued, "we must simulate the conditions which now determine how the Wall Street people think and what makes them do the

(*Continued on page* 17)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SYSTEMS-RESEARCH CORPORATION

Fog Over Tomorrow

(*Continued from page* 15)

crazy things which keep their nation on the jump. For example, why do their stocks almost double in value one day and then drop way back again twenty-four hours later? No one has ever been able to apply ordinary reason to this type of goings-on —too many things are involved. However, with all pertinent data in our machines, we can anticipate these changes and provide our several agents with the subtle and previously unfathomable information they need to acquire the monetary assets of the U. S., just by knowing each day in advance as to how to play—the national mood as it were. Our first investment requires only a few rubles for it will build up fast once we start, for in playing Wall Street Roulette, we always buy low and sell with a profit—we shall never miss! Soon we own American industry, not by the use of force but by having this wealth presented to us as though we earned it: that is, capitalistic style.

"Second, we program the thought processes of all leading U. S. statesmen and politicians. This is even easier than making money since each politician's background is a matter of record; a long record, I might add, if all their speeches are read. Our machine will simply be programmed to give a reply representing the composite of the American position on any question raised. Easy, da? We build planks with transistors, promises with electron tubes, and rationalizations with complex electronic networks. Unlike straw votes which are only guesses, our machine thinks and reasons. The machine will always be right!"

"Brilliant," I injected just to give Petrovsky time to catch a much-needed deep breath.

"And third," Petrovsky now panted, a man obviously obsessed with an intellectual madness, "once we own U. S. industry—once we know the how-about of U. S. politics, so we can exert the desired control, then occupation comes easy and painlessly, for all of the U. S. comes to us who have demonstrated the supreme right to rule and be served—and all this, of course, is for the people."

"The cad," I thought. "For years some ambitious people in the U. S. have used the same concept in a very limited way as their success yardstick, but this degenerate genius wants mass production and will use his solid-state cryogenic computer fed by one million megawatts of power to do it. Furthermore, in his intellectual dedication, he is amusing himself: yes, but those he serves want more than to play in country estates with Fifth Avenue Easter Parade Girls or Atlantic City Beauties — they want power and the servitude of the world's proudest and most successful people. Like in Tibet, they wish the pleasure of conquest: it almost reminds me of some voracious fish which enjoy slashing into bait, eating, disgorging, killing and stuffing again and then disgorging—until utterly exhausted.

"The people's choice—like clams crying for a clambake; or an oyster seeking a stew—ridiculous!"

I shuddered but playing the game —as I now well realized, for my life, I replied aloud, "Marvelous, Petrovsky, when shall we start connecting our machine's wonderful cells?"

"Tomorrow, Comrade Jameski over the top of the Olga River Dam, there is our computer, our liquid helium generators, our almost infinite number of circuits—only good connections are needed and the machine will think like no man ever has."

"Right," I enthusiastically replied.

"We should see you then!" and so saying, Petrovsky stepped out and climbed the stairs to his room above the bar.

I followed soon thereafter, but sleep did not come easily. The thought of becoming a forced partner in the fabrication of a nation-grabbing Frankenstein appalled me with a mournful sort of intrigue. What a quick let-down for Alaska and Hawaii—.

Morning came and after some tasteless food and alleged coffee, I reported in to where I was to become the principal categorizer in linking the billions of elements in such a way that the final entity would possess the knowledge of the White House, Congress, the Supreme Court, Wall Street, the Pentagon and Main Street, U.S.A. —or could Petrovsky be wrong in his wild dreams?

* * * * * * * *

I worked almost as a slave—day after day — nights — months. Free weekends were only memories of yesteryear.

Technicians by the thousands labored over my interpretation of the "why, when, how, and wherefore" reactions not only of American leaders but also the small fry, plus all the other facts of American life. I was provided with all the printed literature on U. S. I needed to refresh my thoughts, including SIGNAL, I might add. It was a most illuminating experience for me—and I grew to respect, even fear the machine, for it was apparent that in the perspective

of all the facts, the future actually seemed to roll quite logically out of the past. I saw how elections were determined by things I had previously not connected them with; stock market fluctuations began to shape up as logical consequences of previously uncorrelated events; wars seemed based upon things which developed as people grew angry and then mad. The gigantic U. S. composite, I knew, of course, actually was a blend of both the male and the female minds and the multitudinous uncertainties this relatively recently acquired political relationship strangely and wonderfully produced. But Petrovsky, I was inclined to think, did not really appreciate this all-important point since his ilk saw nothing in women except a labor force, and the incubators for the world's future population.

Often I thought about this and smiled grimly as I continued with my endless training of solid-state memory elements.

Women?

Many things have failed because of them—nations have fallen; fortunes have been made and then lost;—men have gone nuts, nuts have grown into men—a computer based on logic trying to program a woman's mind—how foolish!

A warmish glow spread all over me, perhaps all was not lost, and I worked even harder. Before I realized it, almost a full year had passed and we were ready for the machine's critical test on predicting American actions and reactions to anything!

The entire output of the Olga Dam colossus came to focus in a single large meter marked YES or NO (Da and Nyet). MAYBE's would not be required for the machine developed no uncertainties. In addition to the big meter, a teleprinter automatically would give a printed answer in words and numbers depending on the question. The questions were punched on tape in any language, since different languages presented no problem to this sprawling electronic monster. The tape containing the questions disappeared into a weird plastic mouth-like orifice, after which billions of cross-correlations were played against the questions; one microsecond of computation time was allowed for each Congressman, two microseconds for Supreme Court Justices, with ten microseconds allowed for the entire Pentagon. Wall Street brokers were given from minus 5 to plus 5 microseconds each, depending upon previous successes. In simple trials on past and current events, like giving the exact population of each state in the Union, even as the name of the state entered the machine, the output immediately gave the last census figure and then impatiently increased with the anticipated population changes right down to the minute. The machine thought of everything including marriages, divorces, sterility, desired size of family, automobile accident rates, love, etc. Other questions referred to past Wall Street records, Kentucky Derby winners, World Series records, possible telephone booth capacities, Big Ten versus West Coast in the Rose Bowl, American history, past political data, etc. The machine was correct every time since all the data required for the answers were stored in its gigantic memory drums.

I was aghast at my success so far!

* * * * * * *

The night before the machine was to be given its first test on predicting the future, I had gone to bed early but for some reason awoke with a start as a full moon bathed my bedroom. As I tossed around, I thought a year back to the many radio and TV stations in the U. S. which would have jumped for the signal I was to have sent as I approached the moon. I thought how pleased the TV audiences and my sponsor would have been had only I been able to point my camera at the rear side of the moon.

A splash of darkness suddenly appeared to modulate the moon-glow. My first reactions were that it was my friend Hams Zeegler of our Astro-Electronics Labs, the next-in-line U. S. astronaut to carry on after me if I failed to reach the moon. Poor Hams, had he struck the moon, but not with a soft landing? If so, contamination; but he would have been first—and a hero! I sweated a bit, but somewhat comfortably so—

"Nyet," it was only a large owl around looking for an earthy mouse and in so doing had inadvertently interrupted the moon's ethereal radiation.

I still could not sleep.

The big Olga Computer, I knew, now had the brainpower of the entire U. S. wrapped up in its memory cores waiting for the big test. What a diabolical way, I thought, to desecrate the new art of cybernetics.

I was a traitor—or was I? Certainly not a hero—

But then again I remembered that a computer's prime asset is that it must be programmed logically, for through logic alone can it reach correct solutions to problems given.

Program a woman and expect logic? Impossible!

As my earlier hunch suggested, perhaps I didn't give a thing to these Acksomanian maniacs, except add to the confusion of their future. Only in the U.S. do women influence men. It is our really big "secret weapon." Program the entire U.S. fund of knowledge as I had done and then ask serious questions pertaining to the future or any questions which must have logical answers and the computer will always be wrong.

U. S. women can hardly be outguessed, even by their husbands.

There are as many combinations of possible replies to possible questions as there are impossible women—or—and then I fell asleep.

* * * * * * * *

It was mid-morning when I awakened. All seemed quiet and peaceful on the Olga. I was supposed to have been at the computer early but I had overslept after my nightmarish unrest.

The computer was to be asked truly critical questions like: tomorrow's Stock Market reactions; 1960 Presidential candidates and who would win; what baseball teams would play in the 1959 World's Series and who would win— 1960 women's fashions—more or less; Is there Uranium in New Jersey—if so, where, etc.?

I knew I was in the dog house for being late but anyway rushed to put on my hat and coat, but it was too late—

Suddenly I saw a flash like ten thousand simultaneous lightning bolts and all the candles of Rome; it came from the dam site over the Olga. The earth seemed to upheave all at once as though one million megawatts had suddenly decided to flip-flop in one direction blowing out billions of fuses. And the sky was aflame!

I ducked as a dodge against the expected explosive wave but it never struck because it seemed like the great shock front and the tremendous vacuum following were too close together and thus probably passed so suddenly that they cancelled each other!

But now out of the sky rained millions of transistors, printed circuits, solid state elements, helium atoms, bits of copper, kippered sturgeon and Petrovsky—almost completely evaporated.

I knew this was the end and that I would be sought immediately by the survivors of Upper Acksomania for they empirically, albeit unwittingly, had just demonstrated that U. S. women seriously influence national affairs but cannot be anticipated—and I was the prime culprit! But before running for a place to hide, I decided to explore Petrovsky's nearby room which fortunately was never locked—history in the making seemed so close.

Cautiously, but hurriedly I entered. There was a mound of notes on the floor, many wrinkled and obviously rejected immediately after writing. But on his desk on the top page of his scratch pad I could see he had written his last words. Holding the paper to the light I read quickly—

"I shall try questions first like these:

1. "Is the absence of woman suffrage in Switzerland evidence of a higher state of civilization than in the U. S.?"

2. "Were sack dresses a factor in the recent lowering of American birth rates?"

3. a. "Should Easter hats be paid for by men, and if so,

b. "Should they be made edible so they can at least be useful?"

4. "Since the American male wears a dinner jacket for the evening meal is that reason why his wife should wear her nightgown for breakfast?"

"Ha, ha, ha—the computer will go to hell with such questions," wrote Petrovsky in his brief memoirs, "but I shall try them, and this will test Jameski too. We shall see things happen, perhaps!"

I grabbed these last notes of Petrovsky and ran for the high hills miles away.

Hours later I found a friendly uneducated shepherd and in exchange for pulling the wool off his sheep, he is keeping me alive until I feel I can emerge and escape back to the U. S. I'll tell you later how I smuggled this letter out for mailing.

Now Mr. Editor, how could any machine—especially one without a female's intuition answer Petrovsky's crazy questions? No wonder hell had broken loose and fission became fusion and fusion became confusion and confusion became explosion. Petrovsky perhaps had gambled on stakes much higher than he had anticipated or did he knowingly commit a glorious scientific suicide? Perhaps — but the answer to this latter question will never be known since Petrovsky is now a part of the earth's atmosphere.

And in conclusion and as mentioned earlier, I have written to you realizing full well my story would not be believed in official channels. But the people the world over should know of this hysterical event so they may think for themselves. Da? Anyway, knowing of your zeal to keep the American male informed, please see fit to lend the columns of your learned magazine to give forth this really big truth—a whopper, as it were!

How about 50 reprints?

Yours very truly,

CHRISTOPHER JAMES

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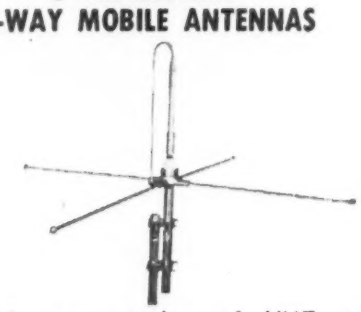

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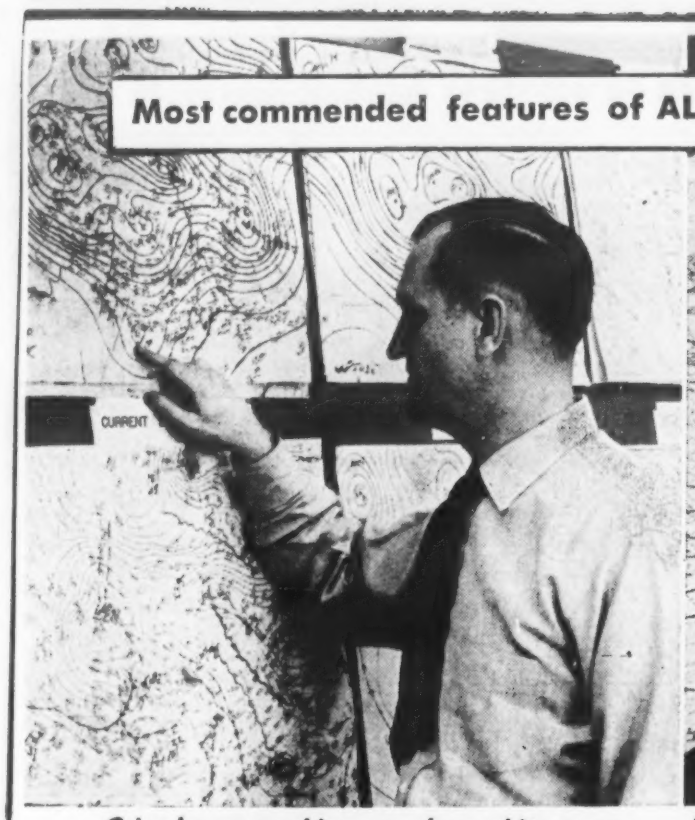

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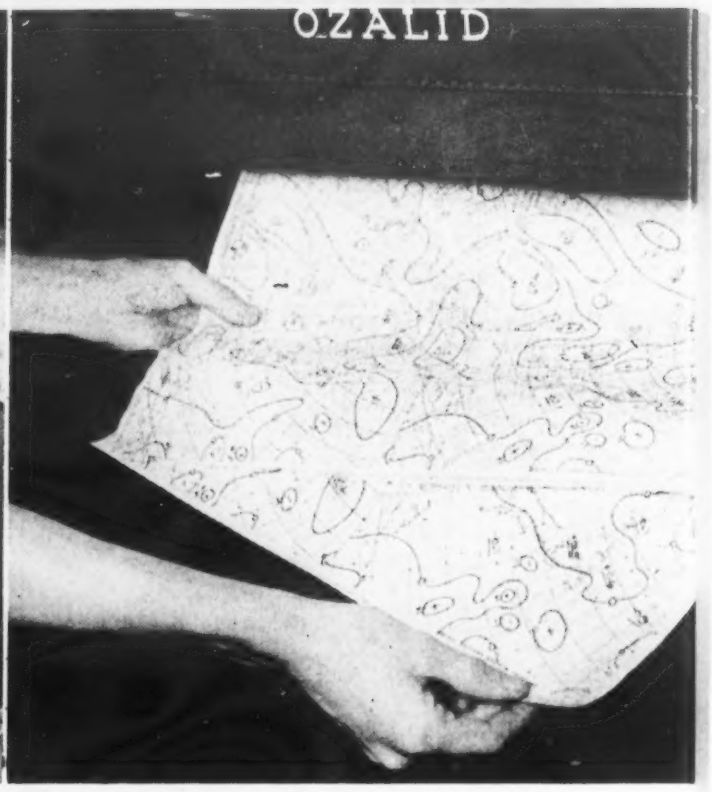

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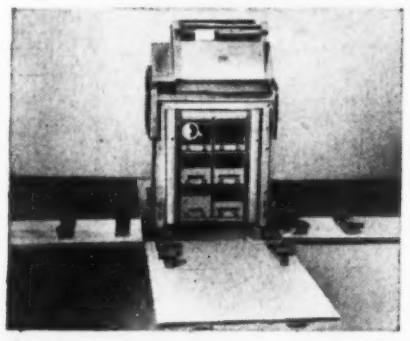
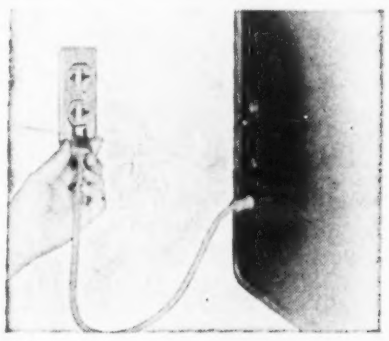
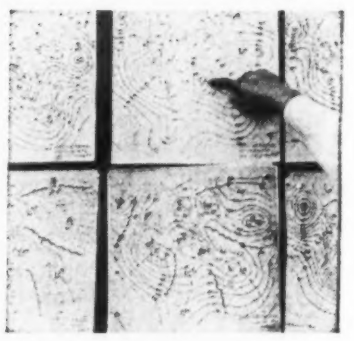


Uncrate

Roll in



Plug in



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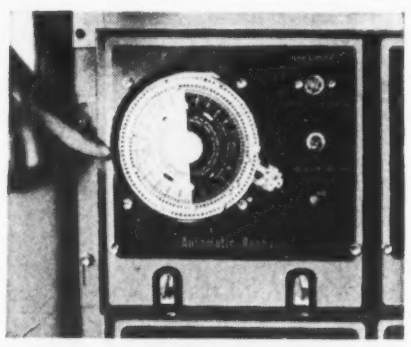
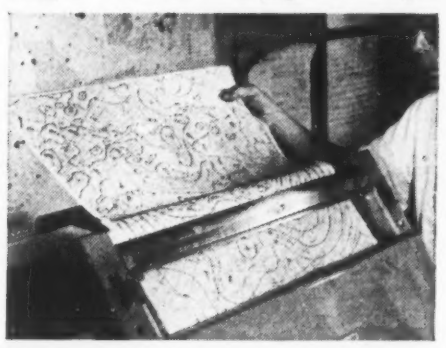
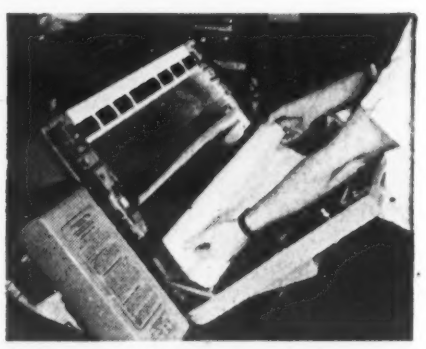


Time clock programming



Instantly visible



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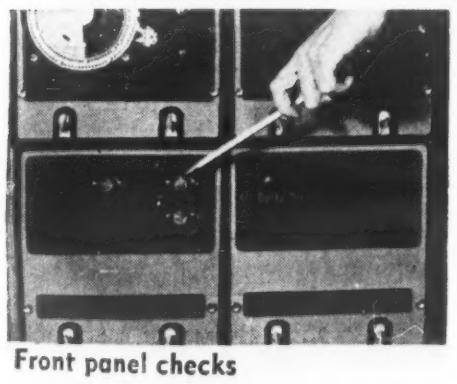
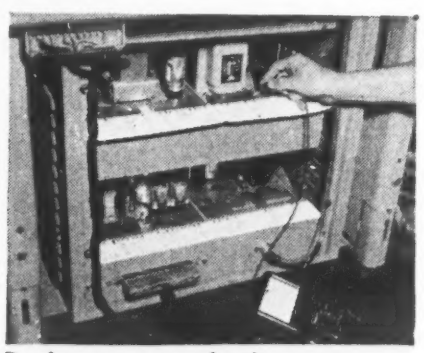
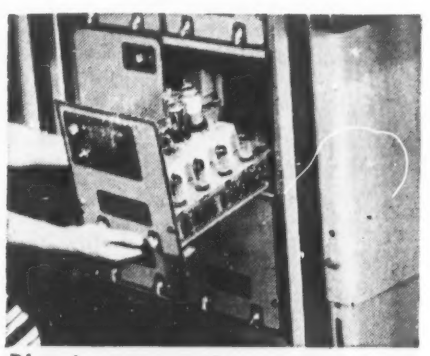


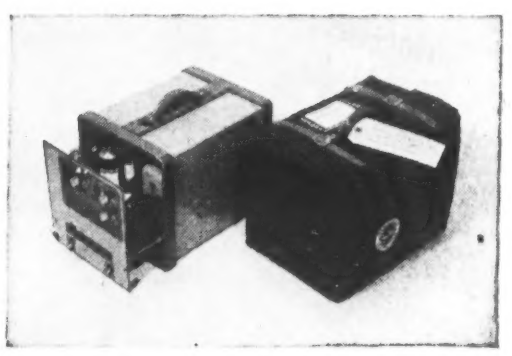
Front panel checks



Back connector checks



Plug-in construction



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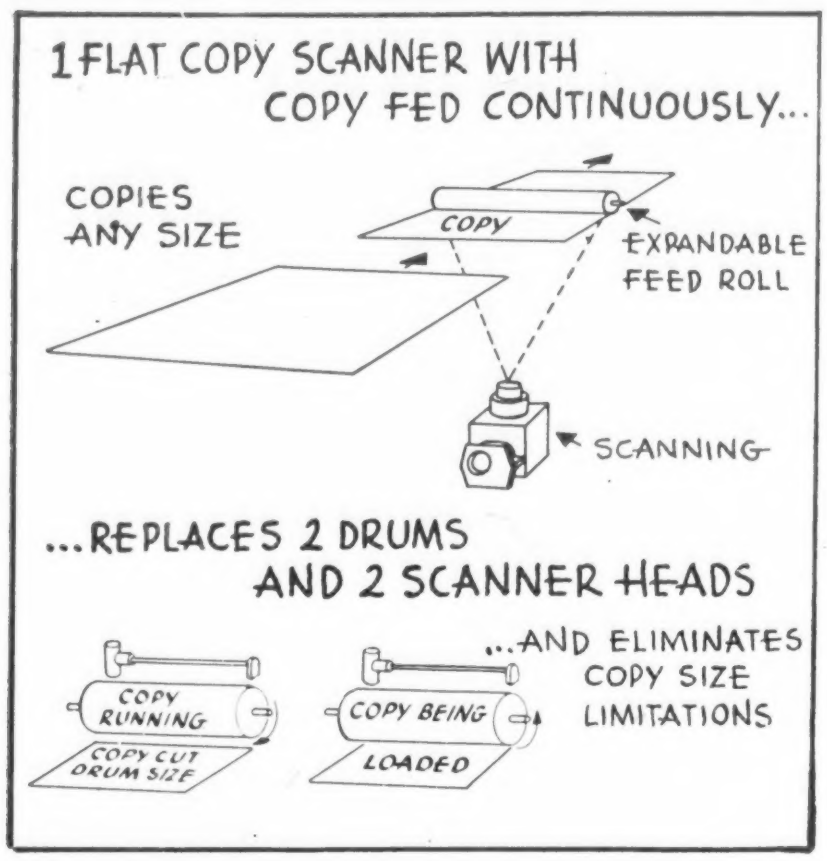

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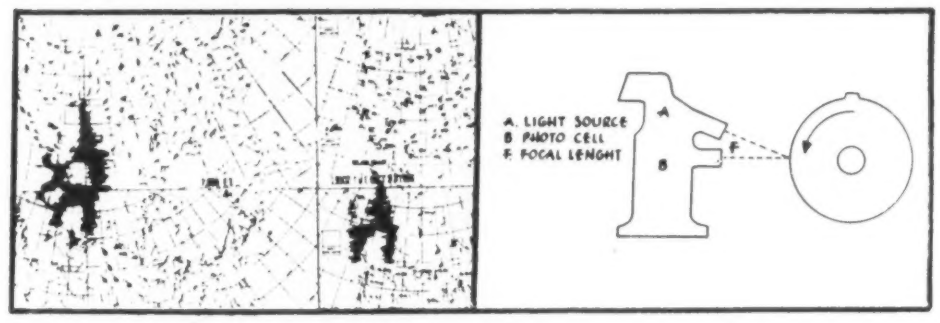
Flat Copy Scanner with expandable copy feed head takes maps any width or length — fed straight or kitty corner.

- **FOCUS SMUDGE ELIMINATED**



Focus smudge caused by unusually thick copy or copy lifting from drum.

With copy feed rolls precisely positioning surface of map on flat copy scanner table, exact focal lengths are maintained for clear, sharp recordings.

- **MOST COMMENDED FEATURES**

Personnel familiar with prior facsimile scanning techniques, lauding this new breakthrough in weather facsimile techniques, highly commend these features:

- ease of copy handling
- compactness and mobility of equipment
- quietness and dependability of operation
- cleanness and sharpness of copy produced

Hi-Altitude Facsimile Weather Drops

will soon be available from American Telephone and Telegraph Co. for qualified companies and organizations. For others interested in facsimile communication systems, Alden Electronics makes flat copy scanner heads and recorders in all sizes and speeds (up to 30 times present network speeds) furnishing components to qualified manufacturers, and complete systems to end customers

We invite your inquiry .

SEARCH

and rescue operational communications — —

PACIFIC

by cdr. h.m. anthony, uscg, staff communication officer, commander western area, united states coast guard

DESIGNED PRIMARILY for peacetime operations, the National Search and Rescue Plan came into force on 1 July 1956 to insure effective use of all available facilities in all types of Search and Rescue missions. The Plan establishes Regional Coordinators for each of the following areas with broad coordinating responsibility: Inland, the U. S. Air Force; Maritime, the Coast Guard; Overseas, the Overseas Unified Commander.

The Maritime Region is divided into two Search and Rescue Areas (SAR)—Atlantic and Pacific)—encompassing U.S. waters, U.S. territories and possessions (except Canal Zone), and certain areas of the high seas in the Atlantic and Pacific Oceans. The Pacific is further sub-divided into three major sub-regions: Northern, Central and Eastern. In turn, the sub-regions are partitioned into sub-divisions or sectors, such as Seattle, San Francisco, Long Beach, Honolulu, Marianas, Hawaii, Midway, Wake, Kwajalein, Adak, Kodiak and Juneau. Overseas, there are the Commander 5th AF with headquarters at Fuchu Air Station, Japan; Commander 13th AF at Clark AB, Luzon R.P., and Commander Alaskan Air Command at Elmendorf AFB, Alaska. They function as SAR Coordinators for those respective regions.

Each sub-division, or sector, contains a Rescue Coordination Center (RCC). Briefly, the RCC is an installation affording its personnel the communications and other facilities required to properly initiate, control, coordinate and terminate SAR within a specific area. The RCC is a highly specialized nerve center, "instantly responsive to distress information, manned continuously by trained personnel for the purpose of gathering and evaluating distress information and for alerting and coordinating search and rescue facilities." By means of an excellent radio, teletype and telephone communications system, it is available to distressed air and surface craft, and is linked with various rescue activities and facilities throughout its operational area.

Role of Communications

The paramount importance of communications in any type of operation is well recognized. Particularly does communications assume the highest priority in a SAR mission. As communications go, so goes the operation! Once it was said that Naval Communications consisted of a piece of bunting, a megaphone and a "bull voice." There has been vast improvement since, but the objective remains to obtain and relay vital information the fastest way possible! You can't direct a ground, air, or naval force, or an SAR operation, in peace or war without an effective communications system. Getting the word to the troops fast has given military commanders headaches ever since Joshua and his famed trumpets leveled the walls of Jericho!

Communications is a broad subject. Its numerous facets include landline (telephone-teletype), radio, radio-teletype, facsimile, underwater sounds and vision (semaphore, flaghoists, flashing light, heliograph, panels, smoke signals), among others. In SAR operations, we are con-

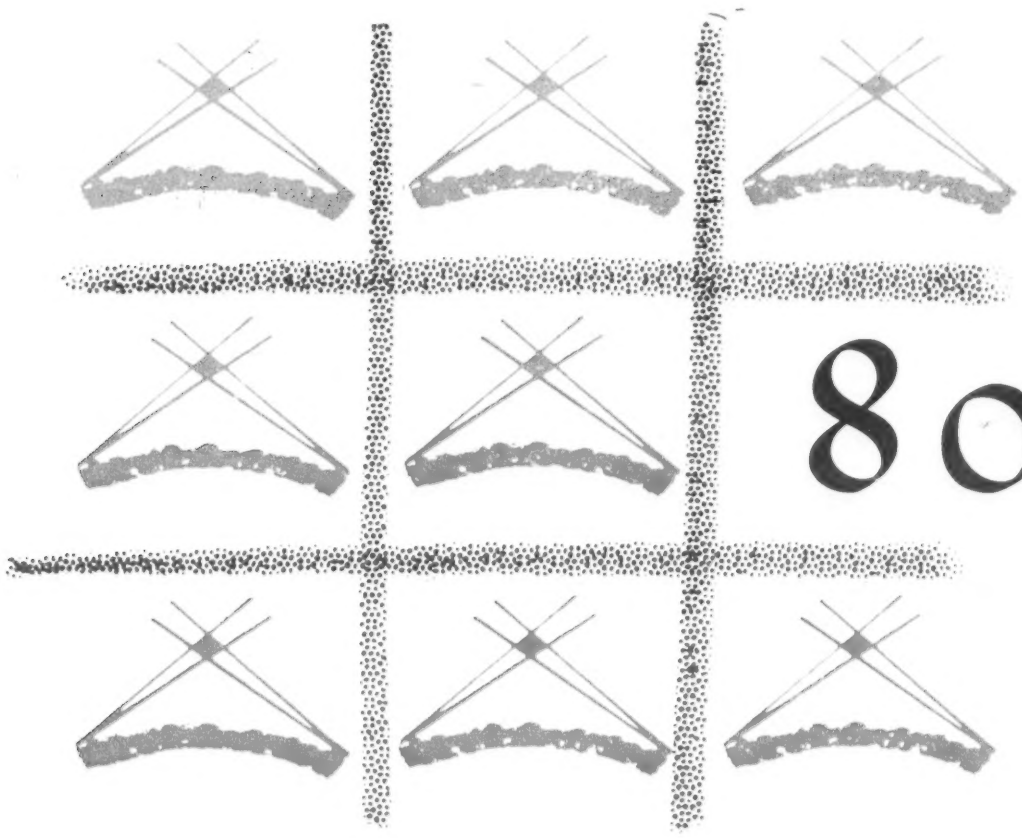
(*Continued on page* 24)

A whole new world of communications has emerged from the utilization of tropospheric scatter. For the first time, voice and teletype messages can be clearly received far beyond the horizon at all times, regardless of atmospheric or electromagnetic disturbances.

Long-range communication between radar outposts and Free World defense headquarters is no longer subject to disruption by weather conditions, and the same reliability is assured for civil telephone systems using tropo scatter.

It was radio equipment by REL which first proved the practicability of tropo communication in the Far North, and of transmission across large bodies of open water. Today, tropo apparatus designed and built by REL may be found halfway around the world.

Eight of the nine major networks in operation or on order utilize equipment designed and manufactured by REL. More kilowatt miles of tropo equipment by REL are in use or in production than those of all other companies combined—significant proof of REL's world leadership in tropo scatter.



8 out of 9

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REL

Search and Rescue (*Continued from page* 22)

cerned primarily with three pertinent types—landline, radio and radio-teletype, all of which serve as the media for inter- and intra-communication between surface vessels, aircraft and shore-based activities. SAR command authority could not be exercised without communications. Nor must we fail to consider the major role played by direction-finders in the medium, high, very high, and ultra-high frequency spectrums and also ship and shore-based radar. Vital bearings, fixes and "steers" obtained by these activities would, without a communications medium to pass them, be valueless.

The communications procedure by which merchant vessels obtain immediate assistance are so standardized that they are thoroughly familiar to qualified maritime radio officers. But the proper procedures are not as well known to operators of small craft, especially in emergencies. One reason may be the comparative newness of radio on small craft; another, that qualified radio personnel are not required as crew members. But the Federal Communications Commission, U. S. Power Squadrons, Small Craft Marine Radio Councils, U. S. Coast Guard Auxiliary, and similar organizations and activities are rapidly educating small craft personnel in communications procedures by means of placard instruction sheets, training courses and word-of-mouth.

Communications speed is never more urgent than in an aircraft emergency. Pilots know the normal alerting procedures so well that there is no need to spell them out. In capsule, they communicate on an en-route frequency with their ground control station, the station notifies the appropriate rescue agency and the wheels begin to spin with the various rescue activities immediately going to work.

But in the case of an imminent ditching at sea, there exists the need to communicate *now* with the nearest surface vessel! This need may exist even when SAR aircraft and ships are rushing to the scene.

We all know that air travel is universal and the primary and fastest means of travel from here to there. As an example, between 13 September and 2 October of 1958, a total of 1034 military and commercial aircraft transited U. S. Coast Guard-manned Ocean Station *November*, located about halfway between Hawaii and San Francisco. And the majority of these were passenger-carriers!

Obviously, in the interest of safety, the operators of these trans-oceanic aircraft afford them the highest degree of maintenance. BUT—each and every one is equipped with the best obtainable type of dual radio and associated electronic gear as well. This is so, in furtherance of safety, to insure that positive reliable communications (both air-surface and air-to-air) are always available!

Now let us examine a specific incident which recently occurred in the Pacific Theater. It clearly illustrates Coast Guard Search and Rescue Operational communications procedures relative to an aircraft emergency involving a possible forced ditching at sea:

2033U (PST) Oakland ARTC (Air Route Traffic Control) simultaneously advises CGRCC (Coast Guard Rescue Coordination Center) San Francisco, and 4th AF RCC Hamilton Field via "hot line" telephone that a MATS C124 #15180, en route Travis AFB to Hickam AFB, Hawaii has declared an emergency; requests intercept aircraft, and is returning to Travis from position 3018N-13642W (Approximately 830 miles SW of San Francisco) due Nr 2 engine feathered; Nr 3 running wild, and fuel critical; altitude 9000 feet; ground speed 184; no passengers; seven crew members; possible ditching at sea.

CGRCC checks ships' plot to determine which vessels on track 054/234.

CGRCC directs CG Air Station San Francisco to dispatch SAR aircraft.

CGC *Gresham*, *Ewing* and WPB 95310 directed to proceed from San Francisco.

Naval Movement Reporting Center San Francisco requested to report position of naval vessels on track 054/234 between 3018N-13642W, and San Francisco.

Naval and Federal Communications Commission HF/DF nets alerted as to MATS 15180 status, and furnished primary and secondary en route frequencies.

CG P4Y and 41st ARS SAR aircraft en route to intercept MATS 15180.

CGRCC passes via direct teletype circuit to McClellan Radio at McClellan AFB for subsequent transmission to distressed aircraft, names of most suitable vessels known to be along MATS 15180 track, their positions, course and speed, together with estimated ditching headings based on existing wind and sea conditions for zones over which aircraft will transit. As aircraft situation continues critical, CGRCC releases "ALL SHIPS" broadcast preceded by alarm signal, through facilities of CG Radio Station San Francisco NMC: "NMC de NMC 1 BT Upon receipt and at end next two silent periods Bcst fol 500 Kcs A2 emission quote Alarm Signal (12 four-second dashes) SOS SOS SOS transmitted for MATS 15180 by NMC (CG RADSTA SFRAN) San Francisco Calif. ck NC Govt emergency 020507 GMT BT Govt USCG all ships within range BT MATS C-124 M15180 position 020404 GMT 3018N 13642W fuel shortage one engine feathered one engine running wild Pd En route Travis to Hono now on turnaround to Travis course 054 true ground speed 184 altitude 9000 Pd Guarding 12345 pt 5 kcs 121 pt 5 Mcs voice Pd Request position course speed wind weather sea conditions and continuous radio guard 500 and 2182 Kcs all vessels vicinity above position and on or near track to San Francisco Pd Replying vessels state if have 2182 Kcs BT COM12CGD SFRAN."

20 Naval, MSTS and merchant vessels respond to the broadcast, and positions of pertinent vessels on track plotted, and MATS 15180 advised accordingly. Vessels not in position to assist are released immediately, to resume their voyage.

(Naval, Coast Guard, MSTS and many merchant vessels in addition to providing a rescue platform, have other capabilities to assist an aircraft forced to ditch, such as transmitting on 410 Kcs to provide ADF homing signals, and the voice communication medium, 2182 Kcs. Factual exercises using these media between commercial air and surface craft as based on procedures contained in Coast Guard Western Area "Shipboard Air Sea Rescue Plan ALFA" have produced excellent results.)

HF/DF nets regularly report radio bearings and fixes obtained on MATS 15180.

CGRCC releases periodic messages to all as-

(*Continued on page* 36)

BUDGET TROUBLE (even for NASA)

by Dr. T. KEITH GLENNAN
Administrator
National Aeronautics and Space Administration

Editor's note: It is believed that the following testimony by Dr. T. Keith Glennan before the Senate Appropriations Committee on July 13, 1959 contains worthwhile information about one of the most important agencies of government.

I WELCOME THE opportunity to appear before this Committee, for the first time. I am here to discuss H.R. 7879 which is now before you. In particular, I want to discuss the crippling reductions in the budget requests of the National Aeronautics and Space Administration that are embodied in H.R. 7978. These cuts, if sustained, would have disastrous consequences, and I am impelled to point them out.

The degree of success or failure of the United States' space effort, vis-a-vis that of the Russians, will be gravely influenced by what Congress decides in this crucial matter.

A year ago last July, the Congress passed the National Aeronautics and Space Act: unanimously in the House, overwhelmingly in the Senate. One of the chief mandates laid down in the legislation was: "The preservation of the role of the United States as a leader in aeronautical and space science and technology . . ."

During later hearings on our fiscal 1959 budget request, some members of Congress raised serious questions about our not having requested far greater sums than we felt, after careful study, that we needed to organize NASA and initiate its programs.

What has happened since then to give anyone a sense of complacency? For I can only interpret the action of the House as an indication of a lessening in the sense of urgency which has been expressed so often on the floor and in Committee.

Have we—who started serious work in the space field six or seven years *after* the Soviets were pouring unlimited funds and their best brains into the drive to dominance in space—suddenly achieved some enormous advantage?

If so, I would like to know about it. I would sleep better at night.

Or has it come about in some way that we know that the Soviet satellites and space probes, which our scientific devices have tracked and reported, were somehow gigantic hoaxes?

Gentlemen, tracking devices such as ours are not easily misled. We believe that the Russians have done exactly what they have announced they have done. And perhaps they have achieved much more that they have not revealed.

Wholesale expression of Congressional support for NASA was evident until very recently. Today the situation is strangely changed. NASA is faced, not with having to decline a plethora of funds, but with the prospect that vital projects will have to be curtailed or even put on the shelf because funds for them are being denied.

I will not be challenged when I say that the United States must bend every effort to achieve a position of leadership in the space field. And we are all agreed that leadership in a race where there are only two participants cannot conceivably mean running second.

I do not have to tell you that we must have the facilities to exert that leadership. Also, we must have the men, we must have the money necessary to the task.

The goal all of us seek—U.S. supremacy in space—was set by Congress last year and reaffirmed this year when Congress authorized the full NASA budget request. This authorization reflected the awareness of Congress that we cannot win the race in which we are engaged during this turning point in history should we be deprived of the all-out support of our legislators.

Therefore, I request, with all the earnestness I can muster, that the cuts in the NASA budget be fully restored.

The reductions in the NASA budget total $68,225,000. They represent cuts both in the $45,000,000 supplemental budget request for fiscal 1959 and from our $485,300,000 budget request for fiscal 1960. Actions in the House caused the reductions.

First, the House Committee on Appropriations cut the combined requests by a total of $45,500,000.

Second, technical points-of-order passed during debate in the House resulted in a further reduction of $22,725,000 in both requests.

I am urging the members of this Committee to make full restoration because to sustain those cuts or to compromise them will hamstring the United States space program.

Moreover, if the Congress slices an already-lean NASA budget at a time when this nation has barely begun its space effort, the world will conclude that the U.S. is having second thoughts about facing the Communist challenge in this field. Realistically, a research and development program of the complexity and magnitude of this one cannot be turned on and off at a moment's notice. Having made the decision to enter the race, and for many other important reasons, we must pursue with vigor an imaginative, well-planned program.

Well aware of the implications of the Russians' commanding space lead, Congress created NASA last year around the nucleus of the highly respected National Advisory Committee for Aeronautics which had been serving the military services and the aircraft industry for 43 years. Our agency became operative on October 1, 1958—one year after Sputnik I began beeping ominously overhead. With NACA personnel and facilities, we were off to a good—if late—start.

From the outset, both Houses of

Congress have given us the strongest possible support. House and Senate space committees have devoted many weeks of hearings to our problems and programs. The House Committee on Science and Astronautics has heard 300 witnesses from NASA, the military services, and private industry during 70 days of hearings so far this year. The Senate Committee on Aeronautical and Space Sciences has devoted a great amount of its busy schedule to NASA's program and the nation's space effort. In connection with our 1960 budget the Committee has published technical hearings of NASA work which are the most comprehensive, understandable, and educational documents on the Federal Government's aeronautical and space activities that exist today.

Both Houses of Congress have this year overwhelmingly approved the requested authorizations for our 1959 supplemental and fiscal 1960 appropriations.

Consequently, I am unable to grasp the reasons for the House cut.

As Administrator, I have resisted the temptation to indulge in Sunday supplement speculation about the coming wonders of space exploration. I have been doing my utmost to see to it that the taxpayers' money is spent wisely as we venture into this new realm and reap its benefits. I have made it a point, however, to be explicit with the Congress about the inevitable costliness of space research. Repeatedly I have stressed during Congressional hearings that NASA budgets will grow in the years ahead.

At the same time, I have tried to convey my deep conviction that space research holds the promise that it may soon be paying for itself many times over in tangible economic benefits. We have every right to count on developments in satellite meteorology, communications, navigation and geodetics that will dramatically affect the lives of all of us.

Taking these considerations into account, last year we put together a budget for fiscal 1960 which we felt would get us well into space exploration. As has been said time and time again, inventions are not conceived on schedule, and vast sums of money, spent without adequate thought and planning, particularly in the early phases of a program, may hinder rather than facilitate projects.

Because space technology is an expensive, fluid affair, it requires continuous review. Since January, when the President submitted our fiscal 1960 budget request, we have found means to get considerable more space mileage per dollar in some areas than originally had seemed possible. We have also discovered that others of our programs will cost more than our original estimates.

When we prepared our first budget estimates back in November 1958, we based our space flight program upon Juno II and Thor-Able boosters. Our studies have taught us, however, that future reliance upon these vehicles would be uneconomical, in fact, that it is almost impossible to justify their use because of their limited load-carrying capacity and lack of versatility. We will, of course, use them for special purpose tasks in connection with particular projects already under way. However, building on the technology developed out of the missile program, we have initiated development of Thor-Deltas, Vega, and Centaurs which—within two years—will enable us to launch much larger scientific payloads far more efficiently and cheaply.

This decision required that we pare our funds for basic research and for other activities. Subsequent studies have also indicated the need for additional tracking and data reduction installations and for the immediate modernization of existing stations. To meet this need, we have again had to trim elsewhere in the budget.

Adjustments like these are by no means unusual in a research program, particularly as we work at the frontiers of a new technology. We must deal with a new order of complexity and cost. We need to build and manage systems that are more than global in scope. Organization of the myriad components into a working whole is a staggering task.

At one and the same time, we find that advances of science generate a flood of new proposals and an unprecedented rate of obsolescence, thus making appraisal, selection, and phasing more and more difficult and complex. Direction and control of technology has become one of today's most pressing and managerial challenges.

As I brought out earlier, our present budget has no slack whatsoever. As further evidence of our tight belts, I would like to state that we do not have a single "backup" vehicle for any of our scientific experiments. Each must be a "one shot" affair, and if the booster malfunctions, we will simply have to lay the experiment aside.

Before spelling out for you just what this cut will mean to our program, I would like to point out that our research centers, which are deeply involved in aeronautical as well as space research, account for slightly more than $100,000,000 of our 1960 request. Actual new money for the space field is somewhat less than $375,000,000. Some or all of the large budget, long lead-time items in our space program, would be affected by the House action if sustained. Here, in brief, is what the reduction could mean to our national space program in terms of time and progress:

1) The development of the Vega rocket propulsion system might have to be drastically cut back. A key vehicle in our future plans, Vega will be capable of placing more than 5,000 pounds in an Earth orbit. It will be one of the first space vehicles capable of making extensive television surveys on the Moon's surface. It will also be used for communications satellite relay experiments and will have the capacity to launch two-man satellites. It will be our first vehicle capable of matching the payload lofting capability of the Soviets.

2) In addition to cutting back Vega, we might have to retard Centaur, another key space vehicle which will be able to place more than 8,000 pounds in a 300-mile orbit and should be capable of soft-landing a 730-pound scientific payload on the Moon. The Department of Defense, as well as NASA, has a strong interest in this vehicle.

3) We would have to eliminate or drastically reduce the $30,000,000 needed for the 1½-million-pound-thrust, single-chamber engine. This is a long lead-time project to provide in about six years' time propulsion units capable of 6,000,000 pounds thrust. Only with this vehicle will it be possible to carry our manned expeditions to the Moon and back. The budget cut will set this back at least one year.

4) Among other long lead-time items on which we would have to reduce the pace is Project Rover which concerns the development of nuclear propulsion for space travel.

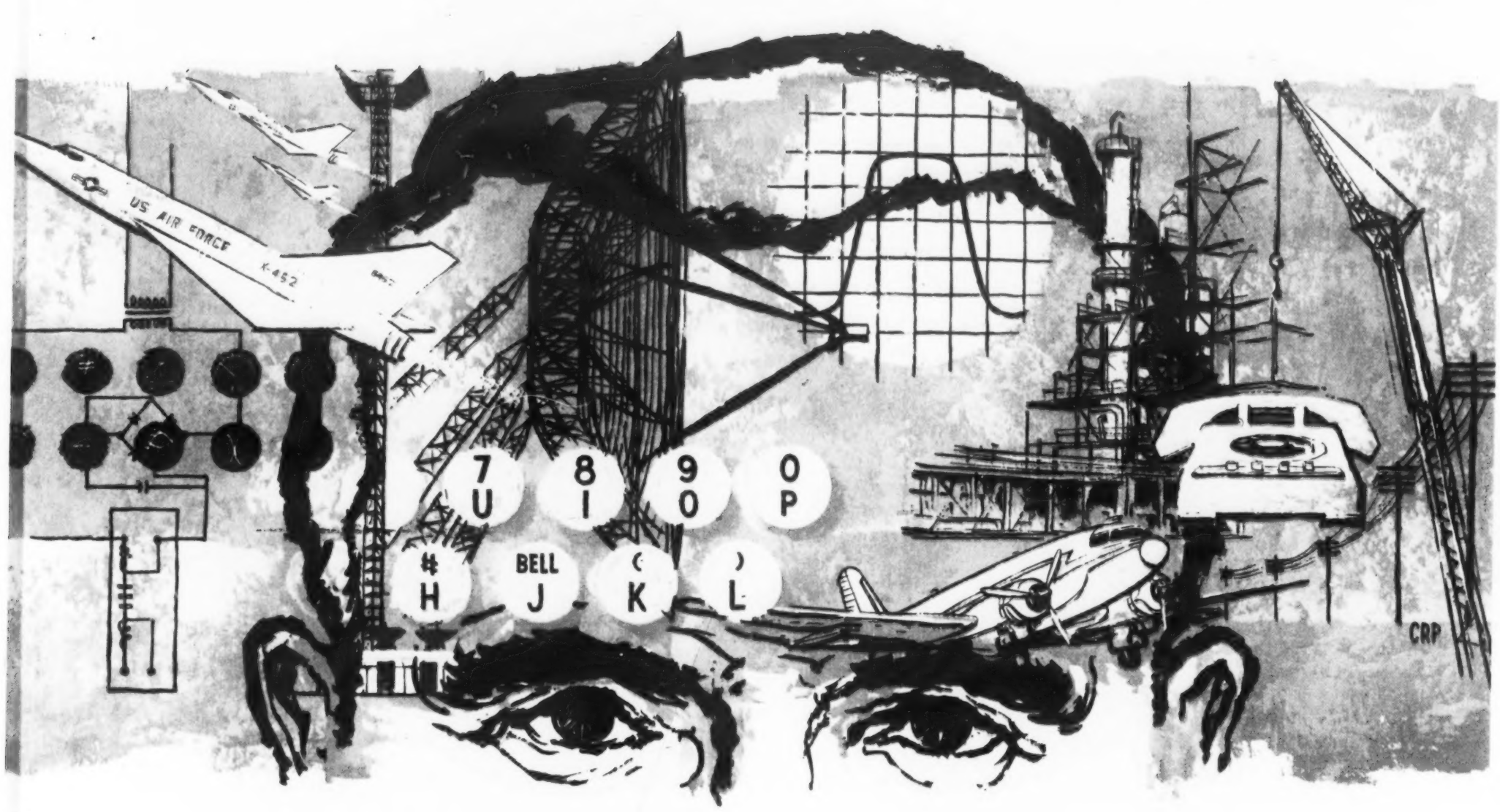
5) We would have to delay completing additions to our tracking and data acquisition networks.

6) Even our top-priority Project Mercury, the manned satellite project, would certainly be affected if we are to carry on with any semblance of a balanced program. This, of course, would increase the probability of the Soviets scoring still another "beat" in this aspect of space exploration.

Let me assure you that I am not crying wolf. While we have not had the time to evaluate in detail the effect of the proposed cuts, it is clear that the items enumerated would be

(Continued on page 28)

ALPHA



. . . MANAGEMENT BRAIN FOR SPACE AGE SYSTEMS

Alpha Corporation was established to expand upon Collins Radio Company's extensive program of design, engineering and installation of complex communication and navigation systems. The entire systems division of the parent company, including its executives and space age specialists, is being consolidated with Alpha. Further, responsibility for the vast projects for government and industry in the Collins systems program is being assumed by Alpha . . . with its greatly augmented staff of designers, engineers, scientists and constructors. Alpha is geared to handle turnkey technical projects of all magnitudes . . . on this continent and in foreign fields. In addition to intricate electronic equipment, Alpha will design and construct related roads, towers and buildings. Alpha trains client personnel or staffs and operates finished installations. Alpha, using the best equipment from throughout industry . . . is the hallmark of world-wide systems management dependability.

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A SUBSIDIARY OF COLLINS RADIO COMPANY

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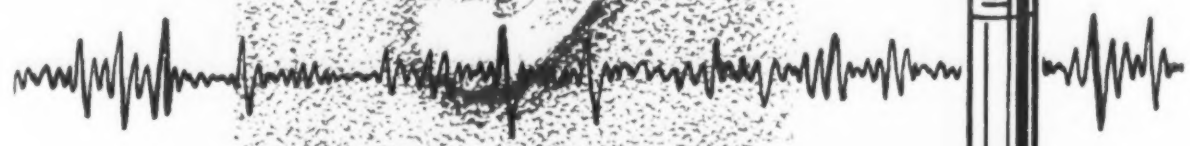
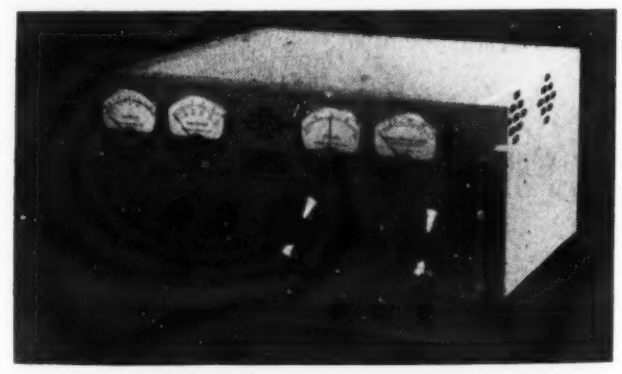
Alpha capabilities include technical systems management in all fields, with special emphasis on: • Space vehicle tracking and communication
Test range instrumentation and communications • Voice, teletype and data transmission • Aircraft modification and overhaul
Integrated shipborne, airborne, and ground communications • High capability remote control and switching

AN EAR TO THE SKY

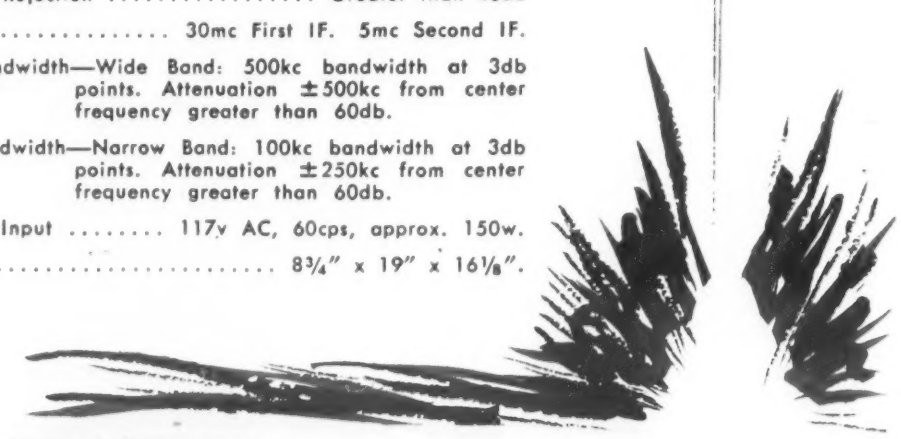


NEMS-CLARKE is recognized as the world's foremost designer and manufacturer of special purpose receivers. These equipments, used for tracking and communication for missiles and satellites, have been installed in practically every missile test facility including ship and airborne operations. In addition, these products have wide application in surveillance, countermeasures, direction finding and similar specialized military functions.



1432 PHASE-LOCK RECEIVER

Tuning Range	215 to 260mc
Noise Figure	less than 8db
Input Impedance	50 ohms nominal
IF Rejection	Greater than 60db
Image Rejection	Greater than 48db
IF	30mc First IF. 5mc Second IF.
IF Bandwidth—Wide Band:	500kc bandwidth at 3db points. Attenuation ±500kc from center frequency greater than 60db.
IF Bandwidth—Narrow Band:	100kc bandwidth at 3db points. Attenuation ±250kc from center frequency greater than 60db.
Power Input	117v AC, 60cps, approx. 150w.
Size	8¾" x 19" x 16⅛".



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PRECISION ELECTRONICS SINCE 1909

(*Continued from page 26*)

those most likely to be affected.

A final, serious matter that I want to mention is the House action which reduced NASA's request for personnel increases and supporting costs. You will recall that when the National Advisory Committee for Aeronautics was absorbed by NASA, 7,699 employees were transferred to the new agency. Along with the transfer went NACA's heavy aeronautical research responsibilities. Since that time, only 1,269 employees have been added to carry the additional responsibilities.

Now, we have requested funds to employ an additional 1,027—a modest increase in view of NASA's mission. The House cut this number by 15 percent. These people are urgently needed to help make up the time that has already been lost. And the management — the sensible management — of a budget of the size under consideration is done by people in adequate numbers and of high quality. We have said that we propose to limit the size of our own staff in favor of contracting a substantial part of the space program. But we need men for planning, contracting and monitoring those contracts. And we must have a sufficiently large in-house operation to assure that we have people knowledgeable in the field to provide the technical judgments necessary for the development of a sound program. Without the men to do the job, we will break our stride and fall even farther back.

The decision in this Nation's space exploration program is up to the Congress. Whatever the decision you make, we will attempt to carry it out with diligence and devoted effort.

The work we are now doing is an important instrument of international prestige. By utilizing their space exploits as an instrument of power politics, the Russians have convinced a large segment of world opinion that success or failure in these experiments is a valid measure of our scientific progress and general cultural status, as opposed to theirs. And there is no blinking the fact that the uncommitted nations are influenced by space achievement.

In conclusion, I want to say that in my judgment, and in the judgment of the scientists and engineers who are with me here today, our 1959 supplemental and 1960 budgets as originally submitted are sound—and conservative. They cannot be reduced without placing in jeopardy some of our most important programs.

AF MARS WESTERN TECHNICAL NET

by
A. L. STEPHENSON
Publications
West Coast Laboratory
TAPCO Engineering
Thompson Ramo Wooldridge Inc.

Western Technical Net, AF Mars Associate Director, Henry H. Waldman, AF6LKY. The W60YI call letters belong to his son.

THE WESTERN TECHNICAL Net (WTN) of the Air Force Military Affiliate Radio System (MARS), completed its first full year of operation in June 1959. In a brief period WTN built up a large and interested listening audience. Responsible for the excellent progress of this newest AF Technical Net are: Capt. John H. Ellison, USN (Ret.) AF6AOI, Net Director and Henry W. Waldman, AF6LKU, Associate Director assisted by Col. Frank J. Shannon, Sr., USAF (Ret.), AF3QR. Spurred by the gratifying results of year 'one' operation the energetic team now is scheduling programs for the coming season.

Educational Feature

The AF MARS Technical Radio Nets constitute a special educational feature of the United States Air Force Military Affiliate Radio System. For stateside coverage three individual AF MARS Radio Nets are involved; the Eastern Technical Net, the Central Technical Net, and the Western Technical Net (WTN). The Eastern and Central Nets were implemented first and have been operative several years. The Western Net began operation in March 1958.

Leaders in industry and in the field of education found a responsive, alert audience in amateur radio operators that does not "sit-on-its hands." The many 'call-ins' received during question-answer sessions clearly demonstrate the degree of popularity achieved. Manufacturers, pleased to have this radio time which features a built-in, semi-technical audience made available to them, cooperate to furnish program high lights. The Net meets each Sunday at 2:00 PM Pacific Standard time, September through June.

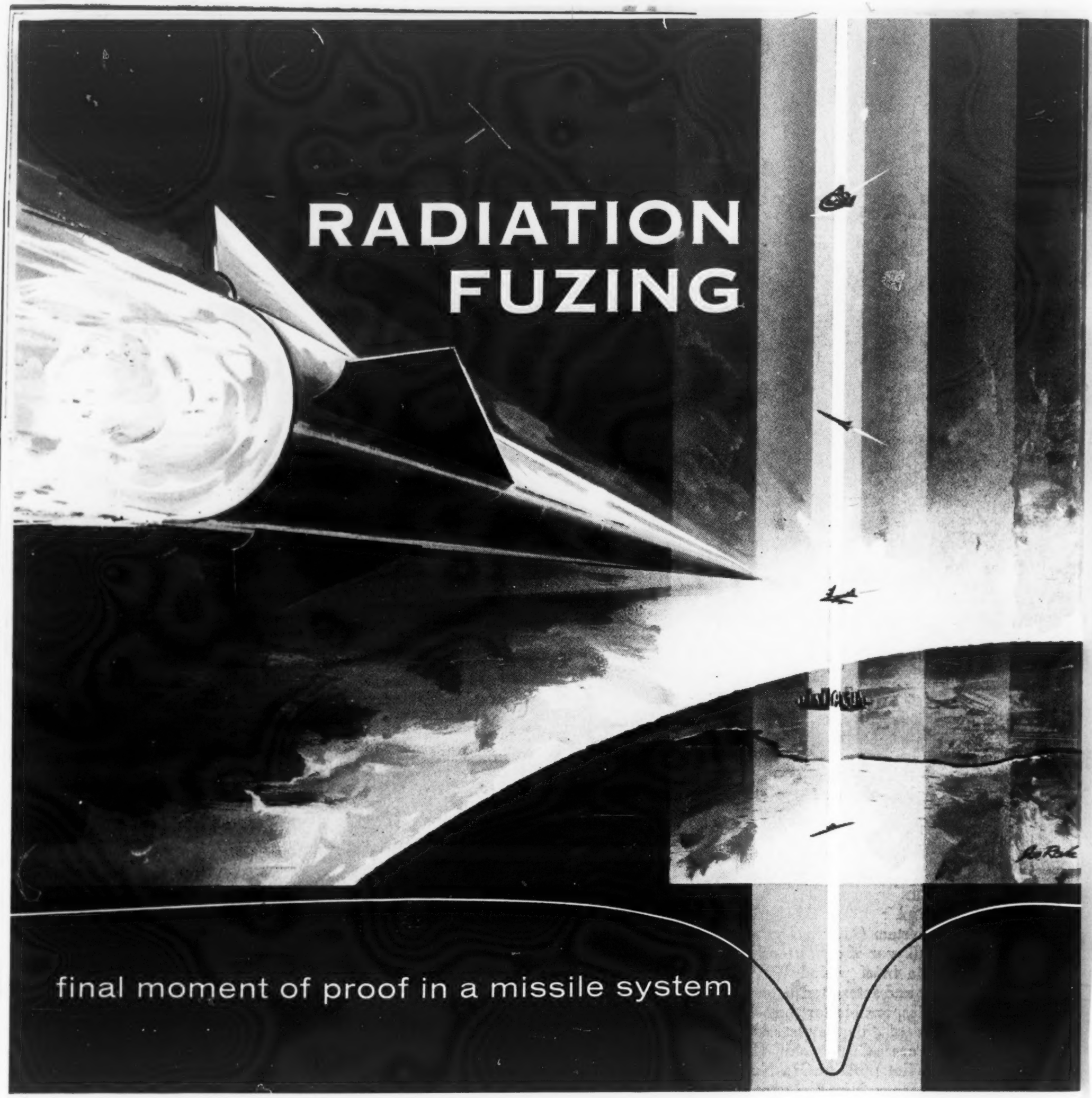
The primary frequency of the Western Technical Net is 7832.5 kcs (7.8325 mcs—voice amplitude modulation). Secondary frequencies for simultaneous broadcast for certain areas are on 3295 kcs (3.295 mcs), and for line-of-sight transmission in the VHF band, 143.46 mcs. A single sideband radio net sponsored by the U. S. First Army MARS, with the Net Control Station in the Eastern Technical Net, operates in the 4 mc band (4030 kcs—upper sideband). This single sideband net meets Wednesday evenings at 9:00 o'clock Eastern Standard time. The AF MARS Eastern Technical Net meets each Sunday at 2:00 P.M. Eastern Standard time on 3295, 7540 and 15,715 kcs.

Outstanding Speakers

The WTN radio broadcasts are in voice transmission, normally referred to as amplitude modulation. Each broadcast is recorded on tape and is sent to the Air Force Eastern and Central Nets for rebroadcast at a later date. The broadcasts offer particularly well-qualified speakers who represent industry, the military, professional societies and institutions of learning. Many outstanding radio amateurs participate in the Net broadcasts.

The MARS Technical Nets have a membership comprised of active and reserve military and civilian members who possess a valid, active, amateur radio operator and station license.

(*Continued on page* 32)



There are hundreds of moments of proof in the life-span of a missile system, but the final, and most dramatic, is that split-second when the radiation fuze fulfills the purpose of the mission. There may be no time for a "second shot".

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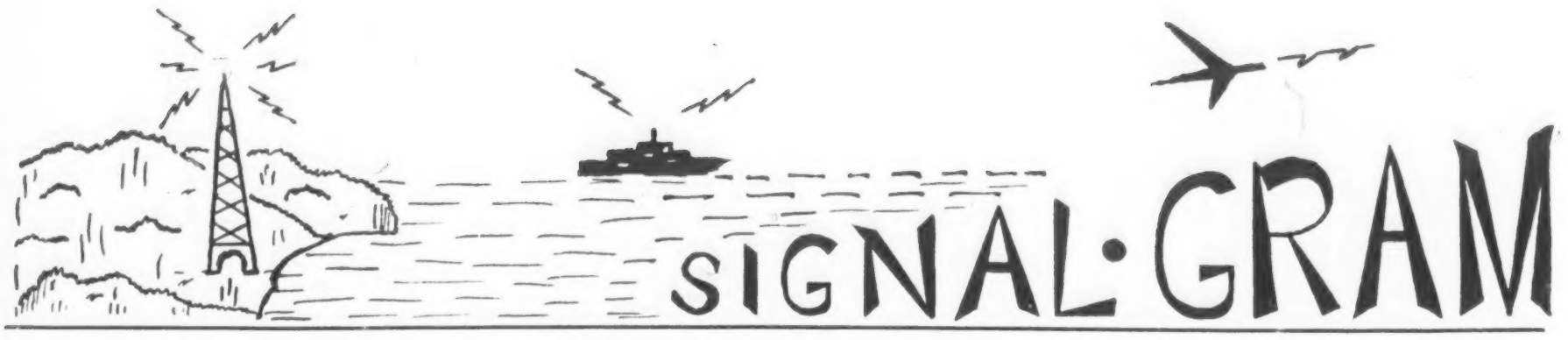

SIGNAL·GRAM

— GOVERNMENT —

A "PADDLE-WHEEL" SATELLITE designed to test the feasibility of using the sun's energy to operate radio equipment in space probes was launched Aug. 7 by the National Aeronautics and Space Administration at Cape Canaveral, Fla. The satellite, Explorer VI, carries solar vanes that give it somewhat the appearance of a paddle-wheel. Scientists reported that the satellite had fed back what was believed to be the first crude television picture of earth ever taken from space.

REDEYE AND BULLPUP MISSILES, two of the latest weapons to be developed by the Army and Navy, were publicly unveiled recently. Resembling a World War II anti-tank bazooka, the Army Redeye, which is fired from the shoulder, is designed to knock down low flying combat planes. Intended for use as an air-to-surface weapon, the Navy Bullpup can be fired from a plane at a target approximately 15,000 feet away. It is believed that this missile will cut the high loss of aircraft forced to fly through heavy ground fire, and improve the reduced accuracy of bombs dropped by supersonic aircraft.

FCC-OCDM PROGRESS REPORT states that the 50-1000 megacycle area will be one of the topics studied by the Federal Communications Commission-Office of Civil and Defense Mobilization technical group in an effort to establish an improved pattern of frequency allocations which could be carried out in the next 10 or 15 years. Among other items, the two-page report issued July 30 notes that the technical group will treat the broadcasting, maritime mobile and earth-space services in its consideration of the 50-1000 megacycle area.

CHARGES ON INTERSTATE LONG-DISTANCE PHONE CALLS will be cut by about $50 million a year, according to a new ruling by the Federal Communications Commission. The FCC ruling, which will affect American Telephone & Telegraph Co. and its affiliates, will bring about reductions effective by mid-September. The reductions will apply only to distances beyond 300 miles.

A REVISED CHARTER FOR NASA-DOD GROUP gives the Civilian-Military Liaison Committee expanded authority to coordinate civilian and military aeronautics and space activities. The principal change in the charter, called the CMLC Terms of Reference, directs the committee and its chairman to deal with jurisdictional differences when they arise between the National Aeronautics and Space Administration and the Department of Defense. The previous charter allowed this type of mediatory action only when requested by the agencies.

"CENSORSHIP PLANNING," a Defense Department directive setting forth guidelines for the military in planning censorship in the event of war, was made public recently. Formerly, this directive was handled as secret information by the Pentagon. It shows no basic change in the emergency censorship planning that has been under way for several years within the DOD and the Office of Civil and Defense Mobilization.

TELEVISION, TELESCOPE AND BALLOON were instruments to photograph the sun used in the Stratoscope I summer flights which were recently completed by the National Science Foundation and the Navy Department's Office of Naval Research. A 12-inch Stratoscope I solar telescope was sent 80,000 feet above the earth in a balloon in order to study magnetic and non-magnetic areas of the sun. The telescope was equipped with a closed-circuit television link, with control of the telescope at the ground, for remote-control pointing of the telescope at the sun.

TOWER TO TEST SATURN BOOSTER READY FOR USE at the Army Ballistic Missile Agency, according to the Department of Defense. The 145-foot rocket engine static test tower was modified to accommodate the 1,500,000-pound-thrust Saturn booster, which will be delivered to the test lab in November. Also, new support facilities were constructed for the operation of the tower. The Saturn booster, a clustering of eight powerful H-1 liquid propellant rocket motors, is being developed by ABMA for the Advanced Research Projects Agency for heavy space applications. *(Continued on page 33)*

Western Technical Net

(*Continued from page 29*)

The Net programs are available to short-wave listeners and/or anyone possessing a radio receiver capable of "tuning in" short-wave bands which cover the respective operating-broadcasting frequencies of these Net Control Stations. (Note for the layman reader: this would be the same as "tuning in" a short-wave international broadcasting station on the short-wave band of your radio receiver.) Non-member Net listeners may partake of the educational advantage offered by these AF Technical Nets. However, without a properly licensed radio transmitter, non-members cannot participate in the question-answer period which immediately follows the formal one-half-hour technical broadcast.

Licensed amateur radio operators who lack military status are invited to join the Military Affiliate Radio System. Official MARS membership information may be obtained by writing to the Chief of MARS, HQ U. S. Air Force, Pentagon, Washington 25, D. C. or to the Chief of MARS, HQ U. S. Army, Pentagon, Washington 25, D. C. Prospective AF MARS members who live in any of the Western States are requested to write the Director of the Western Technical Net, AF MARS, Capt. John H. Ellison, USN, (Ret.), 1720 Holly Ave., Menlo Park, Calif., or his Associate Director, Henry Waldman, 3266 Woodbine Street, Los Angeles 64, Calif.

WTN Director Ellison and Associate Director Waldman each has an elaborate radio MARS Station in his private residence and provides studio originations of the broadcasts. They are assisted further by MARS members chosen as Net Control of the secondary frequency networks. Invaluable aid in establishing the new Net has been given by Col. Frank J. Shannon, Sr., a WTN speaker and moderator on numerous occasions. The informal person-to-person approach used by Col. Shannon in the educational broadcasts provides a relaxed atmosphere for the speaker(s) of the day. This treatment proved to be especially effective as noted in the Eric Burgess* interview "Communication and Space" presented on WTN February 1, 1959.

Emphasis is placed on the fact that the real appeal of the MARS Technical Nets is that a free educational program is offered every individual having access to a listening-in facility. Just twirl the dial on your radio-receiver to any of the assigned short-wave frequencies carrying the MARS Technical Nets. (No cost, no travel, no parking! Do-it-yourself from your easy chair—no fee for turning up the volume on your hearing aid!) Talented individuals, who work each day in geographical areas where the pulse of the electronics industry beats strong, offer food for thought and technical improvement. While the technical backgrounds of the listeners vary, the programs are sufficiently broad in scope to assure the acquisition of additional knowledge by each listener irrespective of his present position in relation to the ultimate in specific electronic 'state-of-the-art' advancements.

Often, printed copies of the highly technical portions of each WTN program may be obtained by sending a self-addressed, stamped (5c stamp) envelope to the Western Technical Net Director or Associate Director. The envelope should be a 9 x 11½ or 9 x 12 inch size.

*Well-known Space author. Mr. Burgess received some unexpected publicity during the past year when it became apparent that two of his books were translated into the Russian language without his knowledge or permission.

In the deadly game of chance we call the cold war, there's no room for guesswork. We must know, every hour of every day, *exactly where our potential enemies' strength lies.*

Electronic Reconnaissance today is one of our major defensive weapons—incredible "eyes" with which we can not only detect enemy radar and missile guidance signals, but determine with precise accuracy the location, type and capability of the signal source as well.

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Signalgram
(*Continued from page* 31)

CONTRACTS: ARMY: Hughes Aircraft Co., improvement of the Missile Monitor anti-aircraft defense system, $7,390,594; Martin Co., production of electronic equipment for air defense coordination systems, $1,900,000. NAVY: United Aircraft Corp., Pratt & Whitney Div., continued work on J-52 turbojet engine used in planes and missiles, $23,500,000. AIR FORCE: Federal Electric Corp. operation and maintenance of the Distant Early Warning Line, $42,101,389; General Dynamics Corp., Convair Astronautics Div., installation of improved Azusa Mark II missile tracking system, $1,706,469; Vitro Corp. of America, Vitro Labs. Div., operation and maintenance of Eglin Gulf Test Range for the Air Proving Ground Center, $6,500,000.

— INTERNATIONAL —

BRITISH RADIO AND TELEVISION EXHIBITION which just closed at Earls Court, London, featured displays from 140 companies with 30 firms offering sound-proof demonstration rooms for stereo listeners. Television receivers containing 110-degree angle tubes and push-button switching from station to station without other adjustments were shown. The British Broadcasting Company set up a sound radio theatre.

GLASS HARDER THAN STEEL BUT LIGHTER THAN ALUMINUM is said to have been developed at Russia's State Scientific Research Glass Institute. according to a U. S. Commerce Dept. Office of Technical Services' periodical. The material, called Sital, is described as a microcrystalline glass containing particles of one-micron size. Uses will include containers for liquid chemicals, machine parts and pipes.

THOR ROCKET BASES NEARLY READY FOR USE IN ENGLAND, according to Air Marshal Sir Edmund C. Huddleston, Vice Chief of Britain's Air Staff. The British rocket bases are the first being built in Europe to strengthen NATO defenses. Date when the bases will be fully operational was not given. Italy will also set up bases for the American rockets.

CANADA HAS PURCHASED A LOCKHEED JETSTAR, according to the Canadian Department of Transport. The 600-mile-per-hour jet utility aircraft, which is currently going into production at the Lockheed Aircraft Corporation's plant at Marietta, Ga., will be delivered in June 1961. The pressurized plane will be used to evaluate navigational radio aids at high altitudes and to set up traffic control procedures for airline and military jet traffic, according to Lockheed.

A RUSSIAN HIGH-SPEED MOTION PICTURE CAMERA which is reported to shoot 33,000 photos a second was produced by the Institute of Optics in Leningrad. The basic principle employed in the camera is the ability of a flat mirror to double the turning angle of a ray.

— INDUSTRY —

RAYTHEON CO. will construct a 100-foot long modulator to test super microwave tubes with power levels several times greater than any known in existence. The modulator, a two-story maze of electronic components, will be housed in Raytheon's new Spencer Laboratory, which was dedicated recently at Burlington, Mass.

SYLVANIA ELECTRO-SPECIALTIES, a new organization responsible for the marketing of closed-circuit television cameras and related equipment, has been established by Sylvania Electric Products, Inc. The new organization will concentrate its marketing activities initially on Sylvania's low-cost TV camera now in pilot production. As new products are developed, responsibility for their marketing will be assigned to Sylvania Electro-Specialties.

LOCKHEED AIRCRAFT CORP. test engineers and an Air Force photo-mapping team are conducting a test series with the new RC-130A Hercules electronic equipment which is capable of pinpointing geographic photo positions within an accuracy of 6 inches over distances up to 500 miles. Ground radio station locations that have been surveyed to within a thousandth of a minute accuracy will transmit signals to the aircraft over the 900 square-mile area near Williams AFB, Ariz.

DU PONT CO. will build a metallurgical research center at its Baltimore facility to speed development of high-temperature metals for jet engines, rockets and missiles and atomic power generators. The installation, scheduled for completion by the fall of 1960, will contain equipment to forge, extrude, and heat-treat refractory metals such as noibium, titanium and zirconium.

REPUBLIC AVIATION CORP. announced plans to "hide" vehicles in outer space as part of the advanced research projects scheduled for its new multi-million dollar Research and Development Center to be completed early next year at Farmingdale, L.I., N.Y. The hiding of space vehicles would be done by making them non-reflective; studies of this technique will be made in an anti-echo chamber.

SPERRY RAND CORP., REMINGTON RAND DIV., has completed the Automatic Data Processing Center at Governors Island, N. Y. The ADPC utilizes the latest developments in electronic computer equipment and procedures for military personnel management. The center enables rapid and efficient administration of the 450,000 members of the Army and Army Reserve in the New York, New Jersey and New England areas.

AMERICAN MACHINE & FOUNDRY CO. will study new materials to enable recovery parachutes for missile nose cones and satellites to stand up under supersonic speeds and high temperature. Under an Air Force contract, the company's Mechanics Research Division will investigate some of the new synthetic textiles and metal and glass fibers.

— GENERAL —

TWO AMERICAN ENGINEERS will visit South America next spring on a combined fact-finding and goodwill tour in an effort to create better international relations. Under the National Society of Professional Engineers' program, Project Ambassador, Rodney D. Chipp, P.E., Director of Engineering of International Telephone & Telegraph Communication Systems, Inc., and Dr. Beatrice A. Hicks, P.E., President of Newark Controls Co., will participate in a series of informal discussions with engineering personnel and inspect engineering developments in South America.

SPECIAL VACUUM CLEANERS FOR MISSILE SYSTEMS have been developed by the U. S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., and are being manufactured by The Ideal Industries, Inc., Sycamore, Ill. The compact, lightweight vacuum cleaners, which have the ability to develop a jet stream for blowing a jet of air, have ¾ horsepower motors. The attachments on the cleaners are made of non-conductive material to prevent shocks when cleaning around electronic gear.

FIRST CLASS OF 97 ENGINEERS to enter Bell Telephone Laboratories' educational program in cooperation with New York University won their master's degrees recently. The men completed the two-year advancd study program at the N.Y.U. Bell Labs graduate center at the Labs' location in Murray Hill, N. J., where they received full salary from the Labs while studying and working part-time in the technical departments.

AN ANTI-SUBMARINE WARFARE EXERCISE was conducted recently by U. S. and Canadian ships. Ten U. S. warships, headed by the ASW carrier USS YORKTOWN, and four Royal Canadian Navy destroyer escorts took part in the exercise which was designed to train joint U. S.-Canadian ASW forces.

INCREASED SHIPMENT OF ELECTRONIC PRODUCTS BY AIR was predicted recently by Chester M. May, president and chairman of the board of Air Express International Corp. Mr. May believes, he said in a company release, that increasing numbers of firms are turning to the use of air freight as a normal means of shipping and distribution.

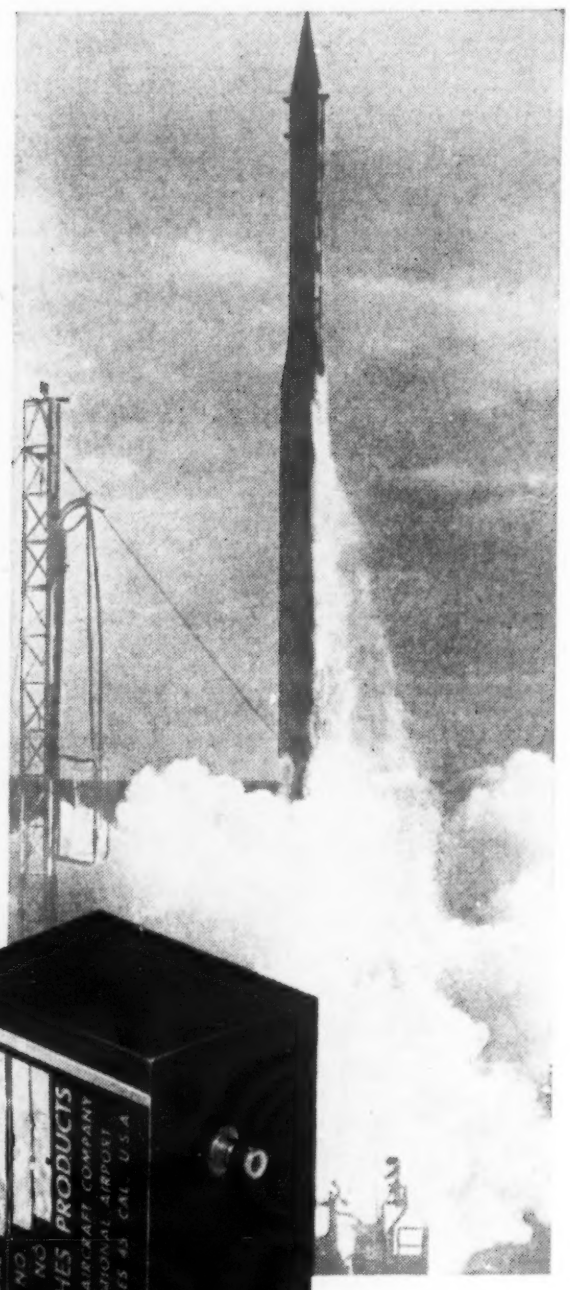
KEEPING TABS ON SATELLITES in order to determine when new ones are launched or old ones disappear is the purpose of a study undertaken by Republic Aviation Corp., at the request of the Air Force's Cambridge (Mass.) Research Center. The first phase of the study, which will take about five months to complete, will be to analyze the trajectory of Sputnik II in order to determine what would have been the best method for predicting its orbit characteristics for its entire life.

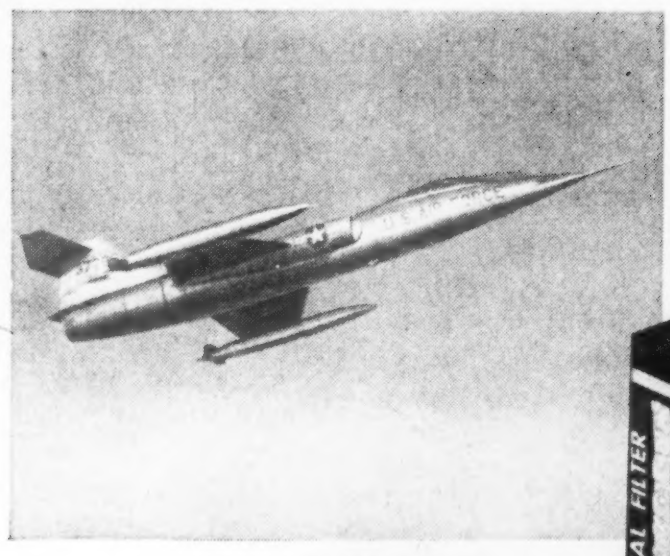
LIFE INSURANCE FOR THE FIRST ASTRONAUTS has been proposed by Rep. Fred Wampler (D-Ind.). Due to the risk involved in their jobs, the seven space men are ineligible for ordinary life insurance.

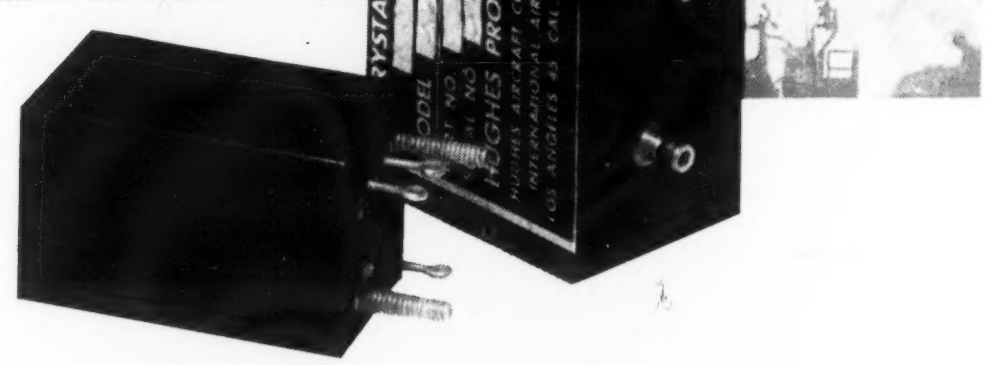
AN INTERNATIONAL TRAINING PROGRAM FOR SMALL BUSINESS was launched by Stanford University's Graduate School of Business and Stanford Research Institute. The program seeks to help managers of small companies in the Middle East, Southeast Asia, Africa, and Latin America upgrade their businesses and be better able to train additional management personnel. The managers will spend a month attending lectures and seminars at the University, followed by a month of training in local industries and another month at the University.

CALENDAR OF EVENTS:

SEPTEMBER 13-20: 10th Annual International Astronautical Federation Congress, London.
SEPTEMBER 21-23: 8th Annual Meeting, Standards Engineers Society, Boston.
SEPTEMBER 21-25: 14th Annual Instrument-Automation Conference and Exhibit, sponsored by the Instrument Society of America, Chicago
SEPTEMBER 28-OCTOBER 1: 3rd Annual Industrial Film & A-V Exhibition, New York.







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Low Passband Ripple—Eliminates errors in information, enables end equipment to be more precise.

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Low Insertion Loss—Enables system to operate on low signal level—thereby combating noise and cutting circuit costs.

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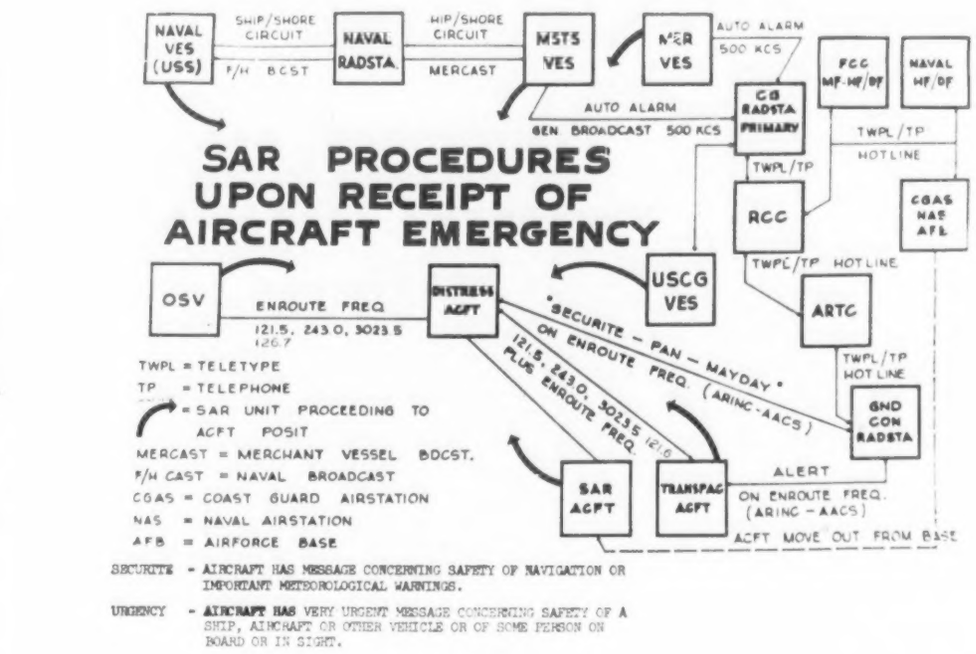


Figure 1

Search and Rescue (*Continued from page* 24)

sisting activities, reporting status of MATS 15180.

2154U CG P4Y intercepts M15180.

2220U Bigwheel 135 aircraft intercepts M15180 in position 34N 13024W, and escorting.

2235U MATS 15180 reports Nr 2 engine back in operation.

2254U CG P4Y and AF SA16 intercept MATS 15180, and escorting.

0115U Oakland ARTC advises MATS 15180 landed safely at Travis AFB at 0105U.

0116U CGRCC originates general broadcast reporting safe landing of MATS 15180 and all assisting units are released from SAR operation.

Fortunately, this incident was brought to a successful conclusion. But the important role of communications is readily seen. (See Fig. 1 for Communications Circuitry.)

Aircraft Emergency

Earlier mention was made that in an aircraft emergency, with a ditching imminent, "there then exists the necessity for communicating *now* with the nearest surface vessel!" It is true that the U. S. Coast Guard operates Ocean Station vessels *November* at 30°N 140°W, *Romeo* at 40°N 172°W, and *Victor* at 34°N, 164°E. Further, at 50°N 145°W, Ocean Station *Papa* is operated by the Department of Transport, Canada. But, between Honolulu and San Francisco, there are 2142 miles of ocean, with only one positive, factual source of assistance approximately halfway on the air track—Ocean Station *November!*

To quote from the Supplementary Flight Document. Pacific and Far East: "If unable to land, and it becomes necessary to ditch, a distressed aircraft shall make every effort to ditch near a surface vessel, and preferably an ocean station vessel. either on station or proceeding to or from station; or any other Coast Guard or Naval vessel. Personnel of these vessels are trained and prepared to assist a distressed aircraft and to rescue personnel immediately after ditching. Before an aircraft ditches, an ocean station vessel will give complete weather information including the length, height, speed, and direction from which waves and swells are moving. These ocean station vessels are equipped and prepared to home a distressed aircraft into the vessel by radar or DF, and to give advice, if requested. At night, U. S.-manned ocean station vessels will mark the ditching area with a line of approach-float lights on a parallel heading of the ditching course previously selected by the aircraft. The vessel will have all deck lights on, and will illuminate the ditching area with star shells and mortar flares, beginning when the aircraft is on final approach."

It is entirely possible that an aircraft in emergency condition may not have the endurance or capability to ditch in the immediate vicinity of an ocean station vessel. However, normally along the track are Naval, merchant or MSTS (military transport) vessels with good assistance capability. Passenger-carrying MSTS's, merchant vessels, Naval and major Coast Guard vessels guard the International Distress frequency continuously, but cargo-type vessels except those of Japanese registry of 5000 tons or over do not maintain continuous radio watch.

Commercial or Air Force MATS aircraft do not carry a radio operator. How can such aircraft contact one of these surface vessels?

As yet, the only positive medium is by calling on 500 Kcs, CW emission. Other than that, for aircraft lacking CW facilities, initial contact is by visual signals, dropped message block, or use of the facilities of another aircraft in the vicinity with a radio operator who can relay for the distressed aircraft, provided contact is made when vessel radio operator is on watch.

But, as previously mentioned, another alert potential is the alarm signal. Most automatic alarm receivers are activated by a series of 12 (twelve) 4-second dashes; some by SOS and others by call letters. The alarm signal may be originated by a coastal station, by a ship at sea, or by an aircraft; it will implement a "live" watch on all merchant vessels within transmission range. Then two-way communications can begin on 500 Kcs. Subsequently, if both vessel and aircraft have 2-3 Mcs radio-telephonic capability, direct contact can begin on 2182 Kcs.

Luckily, most trans-oceanic aircraft, Pacific, and many merchant vessels now have this most important medium, 2182 Kcs. If the vessel cannot transmit on it, the operator can receive voice communications on any MF or HF frequency the aircraft has. And if the pilot, co-pilot or navigator of the aircraft can copy CW transmissions using the ADF, then crossband operation can be implemented.

Figure 2 further illustrates Pacific SAR operational communications circuitry. During the search for the missing Pan American World Airways *Romance of the Skies*, Model B377, Nr 90944 strato-cruiser in November 1957, the participants were Naval (including submarines), Coast Guard, MSTS, and merchant vessels; Naval, Air Force, Coast Guard, Royal Air Force and commercial aircraft, and Naval, Air Force, Coast Guard, CAA and commercial shore-based activities and agencies. Many of the frequencies delineated in Figure 2 were activated

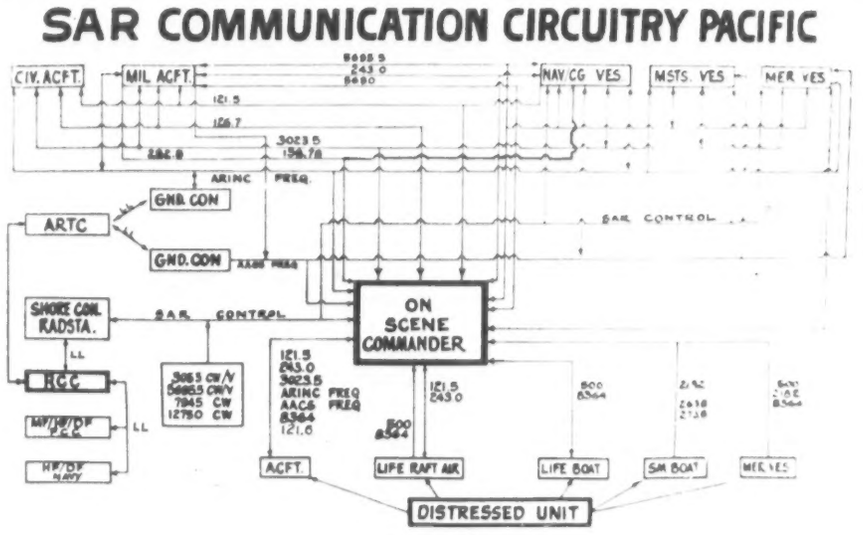


Figure 2

and utilized. The vital operation would have proceeded on "a very slow bell" without such an extensive communications network.

Aside from aircraft emergencies, it will be noted in Figure 2 that communications circuitry provides for incidents involving distressed merchant vessels, small craft, lifeboats and aircraft survival life rafts.

Figure 2 covers the various emergency and distress frequencies: 500 Kcs, International Calling and Distress (CW/MCW); 2182 Kcs, International Calling and Distress for Maritime Mobile Service (Voice); 8364 Kcs CW, International Lifeboat, Liferaft and Survival Craft; 121.5 Mcs (Voice), International Aeronautical Emergency for VHF spectrum; 243.0 Mcs (Voice), U. S. Military Aeronautical Emergency for UHF spectrum. These frequencies are guarded 24 hours a day by many units and agencies—Naval, Air Force, Coast Guard, CAA and commercial maritime. In addition, aircraft en-route frequencies are guarded by ground-control radio stations (ARINC or AACS). Thus, in the event of an emergency, if the distress air or surface craft "sounds off" by means of radio, assistance will be forthcoming!

For aircraft particularly, compliance with the "Five C's" is mandatory! Confess your predicament! Do not wait! Give SAR a chance! Communicate with your ground control station—pass pertinent data concerning your situation on the original transmission. The ground control station has something to work on if communication is lost subsequently, and SAR agencies need all information possible. Conserve your fuel. Climb, if possible, for better DF and/or radar detection. It is expected that when aircraft are flown in a controlled air space under IFR, the pilot will comply with all applicable portions of 14 CFR, Part 60. Comply with instructions furnished; cooperate with and assist ground-control radio and radar station to control communications on the frequency you are using. That is your distress frequency. Do not shift unless positively indicated.

In conclusion, we must discuss the status of survival craft radio equipment such as the original Gibson Girl (500 Kcs), the modified Gibson, or Victory Girl (500 and 8364 Kcs), and the various types of UHF/VHF transceivers and beacons such as the AN/URC 4, AN/URC 11, and SARAH, among several similar types operating on 121.5 and/or 243 Mcs, and which may be carried by trans-oceanic aircraft. Unfortunately, research and development in this field has lagged. For instance, the "Good Old" Gibson, or Victory Girl is as it was in World War II. A 306-foot antenna must be rigged to activate!

Try to get up a 306-foot antenna while bouncing around in the ocean in a liferaft containing 25 people, none of whom probably have ever been exposed to such equipment or conditions!

And if you are fortunate enough to get it up, you have a source of "high" power—2½ watts, to push the signals out on 500 or 8364!

To locate survivors of a trans-oceanic aircraft ditching, there must be a positive, reliable, easily-activated medium of radio signals emanating from the liferaft to enable shore-based and/or surface or aircraft DF-equipped units to determine the survivors' position. The ocean is big. Visual search alone is not enough when human life is in the balance. Perhaps carrier pigeons should not have been retired to "pasture" so early!

The opinions or assertions contained herein are the private ones of the writer and are not to be construed as official or reflecting the views of the Commandant or the Coast Guard at large.

Electronics in the Aerospace Age

(*Continued from page 5*)

Squadron has been activated. The first successful launch of a Thor missile occurred just before Christmas of last year. Each succeeding Thor launch has demonstrated an increasing reliability essential to an operational weapon. (Incidentally, the Thor range is from 300-1500 nm.)

Within the next few months we hope to have in the field the first operational Atlas, an intercontinental ballistic missile with a range of 3000-5500 nautical miles. While we have some development problems with the Atlas, as evidenced by several firings in recent months, we are optimistic that these problems will be cleared up and that we will be attaining the same high reliability with the Atlas we are now experiencing with the Thor. In fact, on 21 July, 1959, an Atlas was successfully fired for a range of 5,000 nautical miles, and for the first time, the nose cone was recovered.

The Titan, also an ICBM, has been extremely successful in its test program so far and like the Thor and Atlas will be valuable not only as a weapon, but as a booster for space vehicles of various types. Just recently, it has been announced that the Titan will be used as the second stage of the Saturn, a scientific vehicle designed to place in orbit satellites up to 10,000 pounds payload.

A new generation of ICBM's is represented by the Minuteman which will be a solid propellant missile much smaller than the Atlas and Titan. With this weapon system, we hope to reverse the trend of increasing cost and complexity that has accompanied the development of advanced performance weapon systems over the years. We expect the Minuteman to be cheap to build and easy to maintain.

The mix of aircraft and missile developments that I have reviewed so sketchily will assure the continued superiority of U. S. airpower. Airpower alone, however, is not sufficient for security. Today, we must think in terms of aerospace power.

The ballistic missile program is our springboard into space. The Thor, for example, has already been used as a successful booster for the launching of satellites which will extend our knowledge of man's capability to fly in space and to come back safely to earth. Also, this program will develop the capability for satellites to be used as vehicles of deterrence—that is as vehicles which will keep earth under surveillance and which will warn us of the launching of enemy ballistic missiles against our country. Furthermore, the capabilities as evidenced in the development of large rocket engines will place man in space in vehicles with capabilities far beyond those that we know today. Perhaps you have heard of the DynaSoar. This is the concept of a glider thrust into space with several stages of large rockets like the Atlas or the Titan. With this type of power behind it, the DynaSoar will be able to circumnavigate the globe in a few hours. Such a vehicle undoubtedly will have military use, but more than that, it will be valuable as a man-in-space research vehicle, and, perhaps, as the prototype of future space transports —transports that will fly hundreds of miles into space in carrying us from one point on the globe to another in a matter of minutes.

And so we look to the future, it is apparent that electronics will, through the ingenuity of the scientists and engineers of our country, contribute in seemingly fantastic ways to accomplishments far beyond those we have seen to this point in history. The progress which lies ahead will serve not only to change our way of life for the better, but also to give us a posture of national strength to preserve the freedoms that we now enjoy.

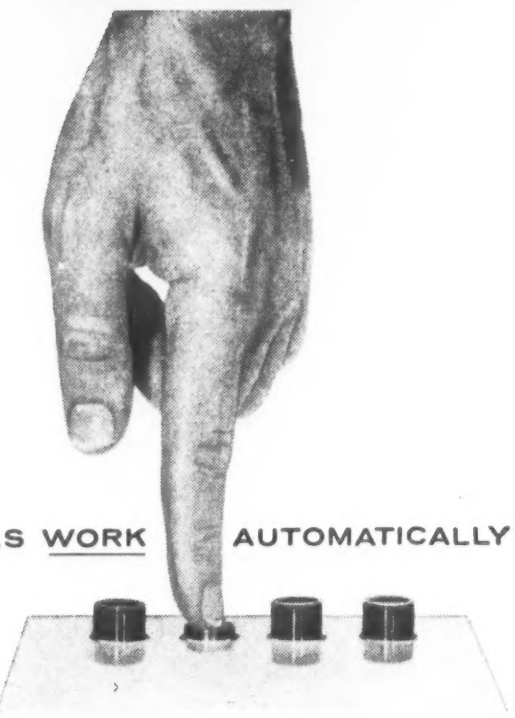
Picture a naval ship's radio system under full dial control from 60 positions. It *has* been done—using basic switching systems developed by AE.

Two separate systems, one with 45 transmitter-receiver units and 30 remotes, and another with 30 transmitter-receiver units and 30 remotes, can be switched to any of 45 frequency channels, and accessed by dialing from the remote control positions. Communications can be restricted to conference circuits or fed to the ship's public-address system.

Automatic switching such as this is right down AE's alley. In fact, AE switchboard equipment is used on *all* first-line ships of the Navy.

If you have a tough problem in communications or control, AE can help solve it. We're equipped to supply the components or complete control packages. For results, write the Manager, Government Service Division, Automatic Electric Sales Corporation, Northlake, Illinois.

AE CAN DO



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ionospheric storms and their effect on radio communications

by Luther C. Kelley, United States Army Signal Radio Propagation Agency, Fort Monmouth, N.J.

THE PHENOMENA RELATED to ionospheric storms are complex and involve several branches of physics. No one completely understands them, but many interesting theories have been developed. However, a great deal is known about these storms and their effects. It is the purpose of this article to describe briefly what these storms are, their cause, and their effects. After going into these phases, I plan to discuss certain recorded indices which indicate the intensities of the storms and finally point out the possibilities of maintaining communication despite these disturbances.

During ionospheric storms the earth's magnetic field or rather the geomagnetic field is also disturbed. For that reason the terms "ionospheric storm" and "geomagnetic storm" are often used interchangeably. The disturbance in the ionosphere and the geomagnetic field exist simultaneously and originate from the same cause. As we shall see a little later, these disturbances are most easily detected by measuring the geomagnetic field.

Ionospheric storms are believed to result from charged particles radiated from the sun. These swarms of particles consist of about equal numbers of positive and negative charges and so are electrically neutral as they stream toward the earth. They travel to the earth in a day or two depending on the force with which they are emitted. The greatest storms are caused by solar flares which blast the particles toward the earth. These flares are unusually intense radiation from areas of the sun's surface and occur in the vicinity of sunspots. Not all flares cause storms. The position of the flare on the sun's disk determines whether the particles from it will be directed toward the earth. Other storms are caused by particles from certain sunspots that may emit them continuously for as long as from 6 to 12 months. At each revolution of the sun the stream is directed toward the earth at about 27-day intervals.

As the particles approach the earth they cut across the earth's magnetic field. Since they are charged, the particles induce magnetic fields which react with the earth's field. The stream of particles compresses the earth's magnetic lines of force as it advances, resulting in a stronger geomagnetic field. This stronger field prevails for several hours and is the main effect of the first phase of the storm. Later in their course some of the particles form a ring current around the earth surface. This circular current produces at the earth a magnetic field which opposes that of the earth. The earth's field is weakened during this period which is the main phase of the storm.

When the ring current is established some of the charged particles are forced to spiral down the geomagnetic lines of force to E-layer heights where they produce auroras. The auroral zones are nearly circular, surrounding the geomagnetic poles at a distance of about 23 degrees. They are about 6 degrees wide. The ionization density in the D-layer is greatly increased and reaches lower levels than usual, increasing the absorption of radio waves. Thus, the LUF (the lower limiting frequency) is raised during periods of disturbances. The F2 layer* rises to heights greater than normal. The density of ionization in the latter region is decreased and the MUF (the upper limiting frequency) is lowered. Thus the band of frequencies usable for high frequency communication is narrowed. If the disturbance is great enough it may disappear entirely.

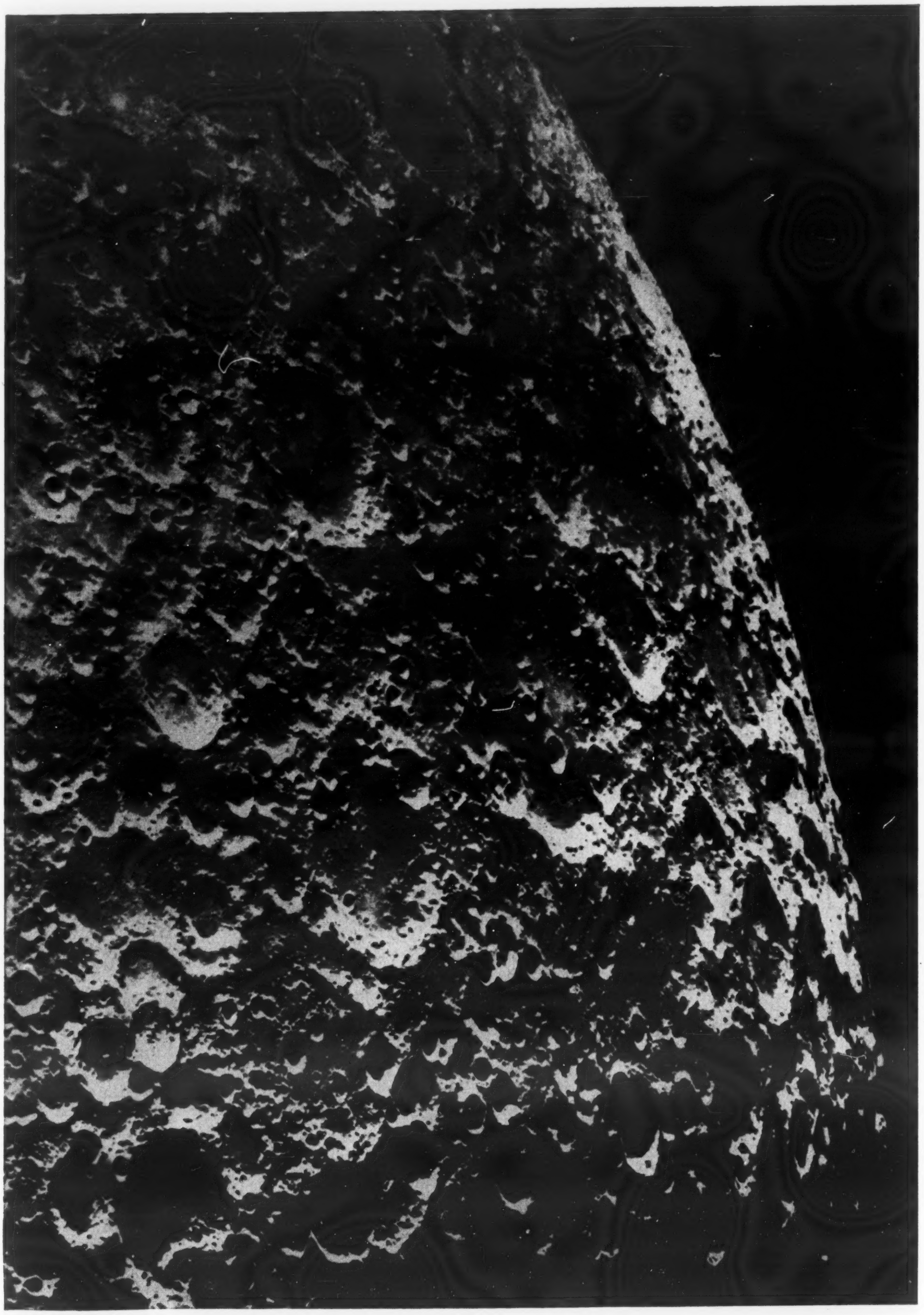
The degree of trouble varies with the circuit path length and its location. Disruption of communication is more frequent and severe over paths that reach high latitudes. The maximum disturbance occurs in the auroral zone. Some east-west paths, such as those between New York and Northern Europe, pass through this zone. Other things being equal, North Atlantic paths are more troublesome than North Pacific ones, for the auroral zone extends farther to the south in the Atlantic area.

The degree of ionospheric disturbances may be determined by referring to certain geomagnetic indices. These indices are based on the changes in the geomagnetic field. One index, the geomagnetic planetary index, designated as Kp, has a scale extending from 0 to 9, a zero value indicating no disturbance. The scale is not linear, and the higher numbers are weighted more heavily than the lower numbers. Another index, Ap, is a linear index on a scale of 0 to 400. Any degree of activity represents some disturbances. A Kp index of 4 or an Ap index of 25 indicates definite disturbance. These indices are given in the *Journal of Geophysical Research*. The Central Radio Propagation Laboratories also publish them in the F series, Part B entitled "Solar —Geophysical Data."

Knowing when to expect trouble is helpful. Since solar flares release particles that result in ionospheric storms, a severe disturbance may be expected to follow the observation of an intense solar flare within a day

(*Continued on page* 41)

*Three general divisions of the atmosphere are recognized. The lowest is known as the troposphere; the middle layer, stratosphere, and the outer layer as the ionosphere. Ionosphere is composed of at least three layers; E, F1, F2, and heights being from 40-50 to 175 or 200 miles. The two higher layers constitute the "F" layer. There is a "D" layer which is quite variable and which appears and disappears almost daily—it could be considered as a fourth or lower layer of the ionosphere.



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Ionospheric Storms

(*Continued from page* 39)

or two—the time required for the particles to reach the earth. Since certain sunspots emit particles continuously for long periods, storms resulting from such particles are expected to reoccur at approximately 27-day intervals at which times the particle stream is directed at the earth as the sun rotates. The ill effects of a storm can usually be forecast several hours in advance by measuring the geomagnetic field. Forecasts based on these characteristics are of the short-term variety. The National Bureau of Standards issues such warnings weekly. WWV broadcasts announcements of North Atlantic radio propagation conditions including warnings on each of the standard frequencies at 19½ and 49½ minutes after each hour. The same service is provided for the North Pacific Area by WWVH at 9 and 39 minutes after each hour. Long-term predictions can also be made. It is not possible to foretell the occurrence of an ionospheric storm for a particular date far in advance, but we can be pretty sure that during certain periods a great deal of storminess will occur. Records of geomagnetic activity observed for many years show that the degree of geomagnetic activity varies in cycles that are closely related to those of sunspot numbers. This is not surprising, for, as we have already seen, some sunspots emit particles that cause geomagnetic storms. Solar flares, which also cause storms, are related to sunspots. However, maximum geomagnetic activity does not occur at the time of sunspot maximum, but comes on an average about two years after the solar peak.

Solar Activity Governs

Since the occurrence and frequency of ionospheric storms are governed by solar activity, their prediction must be based on an estimate of sunspot numbers. Sunspot numbers cannot be accurately predicted for much more than a year in advance. But past observations reveal certain trends of these cycles. The average cycle is about 11 years in length. The rising portion of a cycle is shorter than the downward portion. In general the high cycles rise more rapidly and are shorter than the lower ones. An idea of the general shape of a cycle may be deduced in its early stages.

When all factors are considered a fair estimate of the period of disturbance is possible. The current sunspot cycle reached a peak value of 203 February-March 1958. This is an extremely high value—by far the high-

est ever recorded. We can be very sure that the geomagnetic peak will be high also. In recent studies conducted by the United States Army Signal Radio Propagation Agency it was predicted that maximum disruption of communication would occur during the period, September 1959 through September 1962. Geomagnetic activity is on the rise and trouble may be encountered at any time. At present MUF's are high, and moderate disturbances may be overcome by using the higher frequencies. As solar activity lessens this advantage will disappear. Ionospheric storms of great severity may occur at any time during the next three or four years. Many smaller storms will also occur. Stated in other words, this will be a period of high geomagnetic activity. Some planning now may help to overcome trouble when disturbances occur.

Communication Disturbance

What can be done will depend on circumstances. If an ionospheric storm is great, a complete communication blackout is likely. However, a very small disturbance may prevent communication when signal levels are barely sufficient. In such cases a small improvement in quality may provide usable signals. Greater improvements are necessary to overcome greater disturbances. The problem may be solved by making a contact a few hours earlier than originally planned. The operator may be alerted by listening to the warnings broadcast by WWV and WWVH.

Any means of increasing the strength of the received signal will help. Obviously increased transmitter power and more directive antennas will result in stronger signals. The use of the highest frequency within the limit of the MUF reduces absorption and results in a higher signal level. The signal-to-noise may be improved by noise reduction alone. Single side band operation should help in this department. Further reduction of outage will result from a type of modulation requiring less signal strength. Of course CW is much better in this respect than phone. Anything that improves circuit quality under normal conditions helps during periods of disturbances.

It is often possible to maintain communication by relaying messages through low latitude stations. This is true of east-west paths that pass through high latitudes. The great circle path from New York to London passes close to the auroral zone. Similar paths are very sensitive to geomagnetic disturbances. The closer to the zone, the greater the disruption. Absorption caused by ionospheric storms on the New York-London path could be greatly reduced by a relay through a station in Spain or Africa. Higher operating frequencies could also be used.

Relay Procedure

The relay procedure should be very effective in overcoming the effects of ionospheric storms. The idea is to route the paths through areas of less disturbances. If a relay of two or more links results in a path farther from the auroral zone, communication is definitely improved. It may be that some paths of communication must pass through the auroral zone. In such a case a relay reducing the distance of transmission within the zone reduces absorption. In some of these areas a large storm would result in a blackout, but smaller disturbances may be overcome. Increased signal strength may result from shorter distance in the individual relay link, as well as from transmission through less disturbed areas.

The operator may learn what to do through experience. This discussion has been based on information found in the literature and the analysis of available data. All too often the data available for propagation studies are taken for other purposes. When observations are made for a particular study, the factors are controlled and conclusions are usually more valid. Operators of fixed circuits must maintain schedules and concentrate on getting the message through. The amateur operator is not restricted to a single circuit but may communicate over many paths. I believe you can learn a great deal about ionospheric storms through experiences. Remember that geomagnetic activity varies widely in intensity. It may be great enough to black out all circuits, or it may only block the weak ones. Whenever signal levels are lower than normal for a particular circuit, time of day and season it may be due to high geomagnetic activity. Listen to WWV for warnings and forecasts. The geomagnetic activity indices will not be published until later. Why not make a note of the periods during which performance is poor? Check later to determine whether storminess was responsible. Why not try contacting different areas and find out which paths are most disturbed? When storminess occurs perhaps you can make a prearranged contact with a station over a path less susceptible to disturbance. But here I think your experience will be your best guide.

The 3rd Annual

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Signal School TV (*Continued from page* 10)

vision in coordination with one or more academic divisions. At the present time about 85 training films and 60 kinescopes are programmed per week. Counting re-runs, a total of 250 separate showings occur each week for a total running time of 90 hours.

Training films make up the larger part of the present TV program and probably will continue to do so for some time. Television provides a convenient means of presenting the training film in the classroom according to a prearranged schedule. It precludes the necessity for large numbers of motion picture projectors and projector operators, reduces to one the number of each film needed by the School and makes it unnecessary to move students from the classroom to central viewing areas. Thus, the saving in training time and money is appreciable.

Kinescope recordings made by the Television Division in coordination with the academic divisions are also used extensively in the program. Present plans call for expanding our efforts in making kinescope recordings and for the exchange of kinescope films with other schools doing similar training.

Live programs covering carefully selected areas of instruction and featuring instructors uniquely suited to teaching by television are also carried by the system. The instructor who is to appear in a live program prepares his period of instruction with the advice and help of the Television Division, rehearses it and then "goes on the air." Normally, a live program is run until both the academic division concerned and the Director from the Television Division are satisfied with it, and then a kinescope recording is made. Thus, the School is gradually building up a library of kinescope films for future use.

Among the areas of instruction selected for live presentation by television, the following are typical. First are those subjects covering basic electrical and electronics theory including Ohm's Law, series and parallel circuits, and electricity and magnetism. Instruction on these subjects utilizes the lecture methods primarily, but it is made much more effective by the use of simple training aids and diagrams. Second are subjects like direct and alternating current generators and motors in which it is desirable to use three-dimensional models with moving parts. A third typical area comprises those subjects which require a demonstration of a technique, or the use of tools or small equipment. Included in this third category is instruction on the proper use of hand tools, correct soldering techniques and the use of multimeters and oscilloscopes.

Television presentations of technical subjects average from twenty to thirty minutes in length and are followed by a classroom discussion of twenty to thirty minutes. The purpose of the discussion period is to allow students to ask questions on material presented by television and to permit the classroom instructor to amplify on any points which he believes may not be clear to his particular class. Outlines of the subject matter covered by the TV lesson are passed out to students prior to the beginning of the lesson to aid them in note taking and to identify points that may not be clear to them.

Special types of programs carried by the closed-circuit television include local newscasts, safety lectures, troop information and character guidance presentations, addresses by the Commanding General, and other programs of interest to the entire Post.

A school-level Television Steering Committee acts in an advisory capacity to the School Commandant and to the Director of the Department of Specialist Training, who has supervision over the closed-loop television system. Members of the Steering Committee include representatives of the major departments of the school, the Office of the Educational Advisor to the Commandant, and the Office of Education and Training. The Committee makes recommendations on programming, areas of training in which television can best be applied and selection of instructors for the live programs.

As General Cassevant said at the closed-circuit system acceptance ceremony last February, "Television is no longer an experiment at the Signal School." Eight years of experience in the use of educational television has convinced us, beyond any doubt, that it is a valuable training aid that can be used to supplement regular classroom instruction and improve over-all training effectiveness. Among the many advantages are the following:

a. It permits the use of superior instructors to present instructional material to several classrooms simultaneously by means of live programs or kinescope recordings.

b. It provides an effective instructor training medium in that it allows classroom instructors to observe the methods, procedures and techniques employed by highly-qualified instructors.

c. It tends to standardize instruction at a high level of quality.

d. It provides a change of pace very necessary in intensive training such as that conducted by the Army Signal School.

e. It brings to the student enlarged views of small equipment and components, and gives him a better appreciation of demonstrations by the instructor than is possible in normal classroom instruction.

f. It tends to develop good habits of concentration and listening in that the television screen is the focal point of attention.

g. It will provide an emergency means of instruction during mobilization because it can be used for mass instruction if necessary, using a relatively small number of instructors for live programs or for the making of kinescope films.

h. It results in a saving of training time, man hours and equipment when training films are programmed over the closed-loop system.

i. A kinescope costs far less to produce than an equivalent training film.

Although the Army Signal School now has an extensive program for the use of educational television in training, it also believes that much remains to be done before maximum benefits are realized from this important training aid. Exchange of ideas with other government agencies, and with universities and school systems having educational television facilities is an important part of our program. Within the School, research continues on better techniques for teaching by television, subject matter best presented by television, optimum length of instructional periods, qualifications of instructors for live programs and suitable training aids for studio use. A special research project comparing color television with black and white for educational use is now being implemented. The Army Pictorial Service Division of the Office of the Chief Signal Officer requested the project, and it is being carried out jointly at Fort Monmouth by the U. S. Army Pictorial Center and the U. S. Army Signal School.

Educational television has definitely passed the adolescent stage, but like any young adult, it has not yet reached its maximum potential. Its eventual stature as an effective aid to learning depends largely on the resourcefulness and imagination of personnel using it in school systems. Certainly, it presents a tremendous challenge to all concerned with training, both in the military services and in civilian educational institutions.

INFRARED

"Where Imagination Is King"

by Col. Robert R. Robertson, USA
Chief, Technical Liaison Division, Office, Chief of Engineers

In cooperation with the U. S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va.

LIKE BASEBALL, war has become a day and night contest. The nights when armies retired to their camps after fighting great battles from dawn to dusk left the scene with the five-cent cigar.

Through the years, night fighting gradually increased. In Korea, it reached an all-time high.

Now, night operations have become more important than ever. If men are to survive on the atomic-age battlefield, they must be able to fight, move and work equally as well in the dark as at high noon.

Darkness offers cover and an excellent opportunity to disperse. A troop unit spotted in the daylight must be able to move out of the area at night, or it will be a prime target for a tactical missile.

In an effort to provide our troops with the firepower and mobility required 24 hours a day, the U. S. Army Engineer Research and Development Laboratories, Fort Belvoir, Va., are working on two types of night viewing systems: one using reflected "near" infrared and low level visible light, and the other utilizing emitted "far" infrared.

Near infrared equipment, such as the sniperscope, requires an auxiliary invisible infrared light to irradiate the target. Radiation is reflected from the target, and converted to a visible image by a photoemissive tube. Future viewers in this system will make use of reflected moonlight or starlight.

Far infrared is a relatively new type which detects radiation emitted by the target itself. This passive system enables the soldier to detect camouflaged as well as uncovered targets.

Near infrared devices utilize radiation in the 0.8 to 1.5 micron spectral region. The basic components of all near IR viewing systems are a light source, filter and viewing device containing an image tube.

A searchlight equipped with carbon arc, tungsten or xenon lamps normally serves as the light source. The filter prevents detection by the naked eye. The invisible radiation projected by the searchlight is reflected by the target. An infrared image is then formed by the objective lens of the viewing device on the cesium-silver-oxide photoemissive cathode surface of the image tube.

The image tube is the heart of the near infrared viewer. It converts the infrared image into electrons which are focused electrostatically or electromagnetically to create a visible picture on a phosphor viewing screen. This picture is viewed directly through an eyepiece by the operator.

The tube operates off high voltage, low current power provided by a type c dry cell. Typical power ratings are 12 and 16 kilovolts, dc, with a current of about 0.01 microamperes.

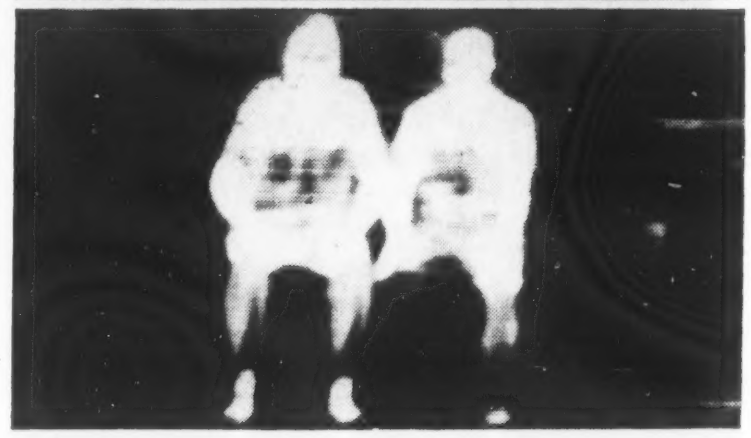
The first U. S. military application of near infrared was demonstrated at Fort Belvoir in 1942 when a hand-held telescope was used to drive a truck along a darkened road. Improvements in the image tube have made many other military applications possible. Sensitivity and image quality have been greatly increased, along with dependability. As a result, a family of powerful, lightweight near infrared viewers is now ready for troop use.

Undoubtedly the most famous member of this family is the sniperscope, the night sight used in World War II. Its bulk and weight hampered employment of the original device. The high voltage power supply for the image tube, and the low power source for the viewer were both carried in a pack on the soldier's back.

The latest edition of the sniperscope is a far cry from the original. Not only have its size and weight been reduced to the point where the device is now practical, but its capability has been so improved that infantry troops can now use it effectively on all their basic weapons, including the 106mm recoilless rifle. (See cover picture and Figure 1.)

Weight reduction was accomplished by making the high voltage power supply for the image tube an integral part of the viewer. The low voltage batteries for the light source are now carried in a small pack on the soldier's cartridge belt. For flexibility in operation, provisions have been made to detach the light source from the viewer. This allows the sight to be used with auxiliary infrared searchlights placed in strategic positions to irradiate critical military targets or areas.

The work-horse of the family is the helmet-mounted binocular, which permits troops to drive vehicles, build



(Fig. 1 — upper left) "Aggressor" is viewed by soldier using the new sniperscope, which can be mounted on all basic infantry weapons, from the .30 caliber rifle to the 106mm recoilless rifle. (Fig. 2 — lower left) Driver of mechanical mule equipped with infrared binoculars. (Fig. 3 — upper right) Night patrol checks map in dark with help of infrared viewers. (Fig. 4— lower right) Picture taken by thermograph, the passive infrared device which utilizes radiation emitted by target.

roads and bridges and fuel missiles in complete darkness. The transistorized power supply for the two 12kv image tubes used in the binocular is mounted on the back of the helmet to serve as a counterbalance. (See Figure 2.)

Vehicle headlights covered with filters provide light for night driving. Other operations are performed with the help of infrared floodlights.

The smallest device in the system is the metascope, a hand-sized viewer which is especially useful in map and sign reading, and as an assembly aid after an air-drop. The power supply for its image tube is a tiny internal hand-cranked generator which charges a condenser for operation up to 45 minutes. (See Figure 3.)

Armored units will also find new infrared developments helpful. Tank periscopes and telescopes have been converted for night driving and firing. A dual-purpose, infrared visible searchlight and hand-held binoculars are also used with this system.

The engineers haven't forgotten the unit commander, either. Now under development is a tripod-mounted infrared telescope which will enable the field commander to study a tactical situation, deploy his forces effectively and observe the progress of a night battle from a remote vantage point.

The image tube is the key to further progress in near infrared viewing systems. If a suitable tube is developed, infrared battlefield television will be a reality.

In the early stages of development is a new device which will enable troops to see at night with the aid of light obtained from the stars. Called the "cascaded photosensitive image intensifier," it gathers the reflected starlight or diffused light from skyglow falling upon the objective. It then intensifies or amplifies the diffused light sufficiently to present a distinguished image.

The image intensifier is essentially the same as near infrared viewers, but requires no searchlight to irradiate the target.

Instead of the silver-cesium-oxygen surface, its tube has a visible sensitive photoemissive surface. The heart of the viewer, the cascaded image tube is actually two tubes working in a series, and operating through an optical system which focuses the light reflected in the field.

The first tube acts as a preamplifier for the second, which in turn further amplifies or intensifies the light and presents the image on the viewing surface. The tube is powered by current at approximately 25,000 volts, furnished by a compact six-volt battery through a system of transformers and transistors.

The intensity of light furnished by the stars is so low that it is of little or no value to the unaided eye in seeing at night. If the image intensifier is perfected, however, starlight will make it possible for troops to see at tremendous ranges.

Far, or passive infrared, utilizes radiation in the spectral region from 1.5 to beyond 14 microns. Viewing systems have been built around both scanning and non-scanning types of detectors which obtain thermal patterns of objects and areas at temperatures from zero to 500°F.

Several scanning devices are under development, including the thermograph. This device produces a two-dimensional picture by scanning the far infrared image over a thermistor bolometer detector which has uniform sensitivity over a large wavelength range. The electrical output signal from the thermistor bolometer is amplified and modulates the light from a lamp. This light beam then is scanned across a photographic film in synchronism with the initial pick-up scanning system, and produces a picture much in a manner similar to the wirephotos used in newspapers. The scanning time varies from one to 30 minutes, depending on conditions and requirements. (See Figure 4.)

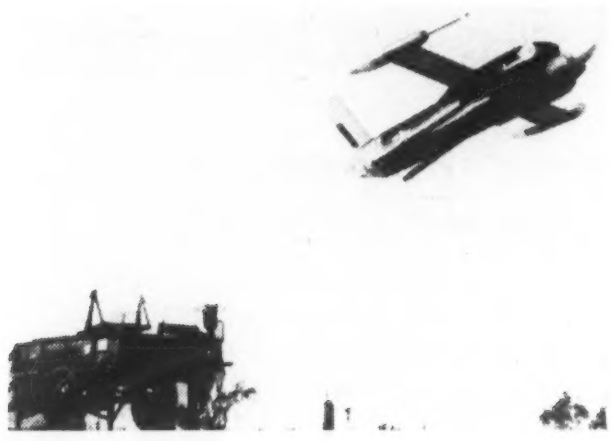
One of several non-scanning far infrared viewers under development is the "evaporograph." In this device, the thermal pattern is imaged on a thin membrane which absorbs the radiation and forms a picture. By causing evaporation, this heat picture changes the thickness of an oil film on the back of the membrane. White light, projected on the film, produces an interference color picture which is viewed directly or photographed.

Initial far infrared viewing systems will provide combat soldiers with means for night reconnaissance, weapons firing, terrain mapping and camouflage detection. Eventually, far infrared will monitor a battlefield automatically. It will detect enemy targets and feed this information to a high speed electronic computer which will determine range, location, the nature of the target, the required weapon to destroy the target, and complete the job by firing the weapon. All of this will be accomplished in a matter of seconds.

Someday, far infrared may also be the eyes of satellites looking into every corner of the world. It may monitor missile traffic, map the surface of the earth and see into the heavens.

In the field of infrared, the Army is limited only by the imagination of its engineers and scientists . . . not possibilities.

At the Engineer Research and Development Laboratories, the slogan is "Where Imagination Is King."



Infrared Activities of the Army Signal Corps

by T. E. Gootée

Office of Technical Liaison

Office of Chief Signal Officer

Remotely controlled surveillance drone uses an IR sensory unit or a photographic, radar or television device to obtain information. Wing pods are for test only.

IN THE SPECIALIZED area of IR or infrared work, the Army Signal Corps actively pursues a continuing program involving the research, design, and development of IR equipment and systems.

Although important results accrue from basic research, the effort of the Signal Corps is primarily concerned with the development and production of IR surveillance equipment to improve the Army's combat capability.

There are two principal areas of Signal Corps military IR application:

1. Ground-based detection devices.
2. Airborne sensory units.

A complete sensory unit is composed of an infrared detecting element (a minute amount of material extremely sensitive to infrared radiation), a scanner (an optico-mechanical device) and a monitor or viewing apparatus.

Information gathered by a sensory unit is either viewed directly on a cathode ray tube or, in the case of some airborne applications, is broadcast to a ground station via a data-link transmission system where the information is viewed immediately or stored for subsequent evaluation.

Ground-based Devices

Several kinds of intrusion detection devices are being developed by the Army Signal Corps as part of its combat surveillance program. These are ground-based equipments designed for the detection of either personnel or mechanized vehicles.

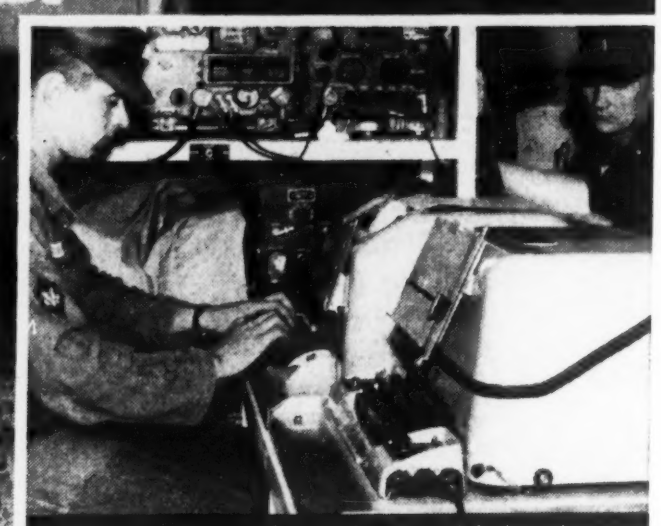
From a functional standpoint, these devices resemble some of the new types of ground-based radar surveillance equipment developed by the Signal Corps.

Although IR detection devices are

(*Continued on page 66*)

COMBAT MOBILITY

telecommunications move up-front with the advance



Interior view of tracked vehicle above

Kleinschmidt teletypewriters maintain constant contact, in print, between U. S. Army command and field positions

On the go...bouncing over bunker or beachhead ...Kleinschmidt teletypewriters accurately, efficiently send and receive printed messages. Developed in cooperation with the U. S. Army Signal Corps, these units instantly provide both sender and receiver with identical data...*printed on paper!* In recognition of its quality, Kleinschmidt equipment is manufactured for the U. S. Army under the Reduced Inspection Quality Assurance Plan. This kind of proved experience is now available for unlimited advances in electronic communications for business and industry.

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PANEL DISCUSSIONS

A vital part of the 13th Annual AFCEA Convention was the panel discussions in which research and development in various phases of electronics, communications and photography were explored. These discussions by outstanding leaders in industry and the military offered valuable information to their enlightened listeners. The following two articles are the second in a series to be published by SIGNAL. Others will appear in subsequent issues of the magazine.

PANEL: *Space Tracking*

SPEAKER: *Col. Gordon T. Gould, Jr., USAF, Assistant Deputy Commander for Weapon Systems, Electronics, Andrews Air Force Base*

I wish to express my appreciation for being afforded an opportunity to address this forum on what I consider to be a very significant aspect of this discussion's rather inclusive title. I should like to confine my remarks to an area of military systems management which is considered to be not only extremely important but potentially a source of many major problems. Briefly, my subject concerns the trend toward automation through the employment of large electronic data-processing and control systems in the military scheme of operations. I shall begin by saying that it is my intent to stimulate discussion on this subject by portraying a number of problems which appear imminent from the Air Force point of view.

The Air Force, as well as the other Military Services, is undergoing a revolution which might well be compared to the Industrial Revolution of the 19th Century with which all of you are very familiar. This revolution we may call, for our purposes, the "Trend Toward Automation." This trend is brought about by two very real factors in military operations. *First*, the advent of the nuclear bombs provided heretofore unknown explosive force in sizes and weights comparable to those of the more conventional warheads. This implies that where in the past it was necessary to deliver hundreds upon hundreds of bombs for destruction of a large target complex it is now possible to deliver the same destruction with a single warhead. Such a situation alone would be enough to necessitate considerable change in tactics even if the weapon systems employed for delivery remained the same. This, however, has not been the case and brings me to my *second point*. The over-all performance characteristics of delivery systems have improved many orders-of-magnitude in range, speed, altitude, and essentially all other parameters. We are now facing an era wherein untold destruction can be delivered in a matter of minutes through such weapon systems as the Inter Continental Ballistic Missile.

Even to those of us in the military who have watched these capabilities grow, the two factors of increased yield and decreased reaction time—both by many orders of magnitude—come as something of a rude shock. We must realize that these changes have come about in little more than a decade and in turn have caused military people to throw away old methods of doing business and seek methods more suitable to the occasion.

For example, in the mission area of air defense, an attrition level of 20 to 25% in WW II was considered high enough to cause enemy strategic forces considerable concern up to the point of even abandoning a strategic air offensive. Such losses could not be sustained through the long period of time necessary to effect the required destruction. Today, however, when the defensive job is many, many times more difficult due to the improved strategic delivery capabilities, an attrition of 90 to 95% is mandatory if the defense is to be even reasonably successful. A few warheads, appropriately placed through the defense, can now cause destruction even greater than that of many weeks of bombardment under the old rules.

On the strategic side there are different but equally difficult problems. We in this country consider our strategic force as a deterrent rather than as an initial offensive striking force. Many of you have probably heard the expression that "SAC has failed in its mission if it ever has to drop the big one." This function, as a deterrent, in times of very active cold war, small wars, and the threat of a hot war makes the strategic control problem most difficult. We must be absolutely certain of all factors before ever launching a strategic attack.

We come, therefore, through these two examples of defensive and offensive air actions as we know them today to the main point of our discussion. Man's sensory and reaction capabilities, in terms of speed coupled with voluminous data assimilation, are wholly inadequate to meet the situation. For a specific example, in a ballistic missile attack as we now envision it, we will have no more than 20 minutes to collect the data, process it, display it, and to react appropriately. The importance of a timely reaction makes it absolutely necessary that every conceivable form

(*Continued on page 49*)

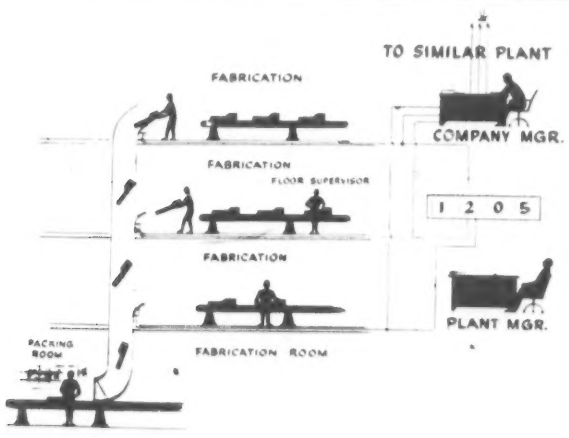


Figure 1

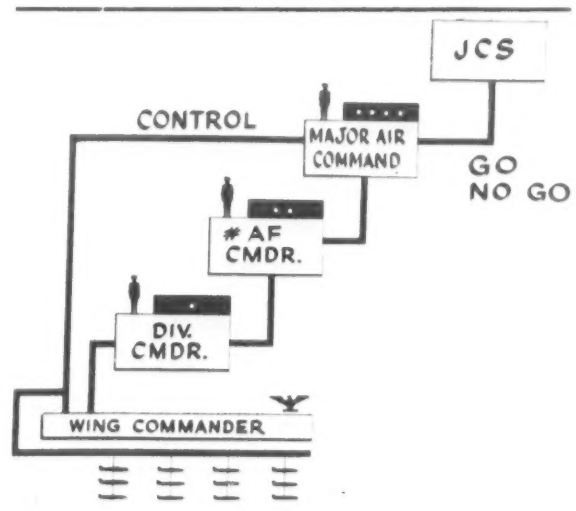


Figure 2

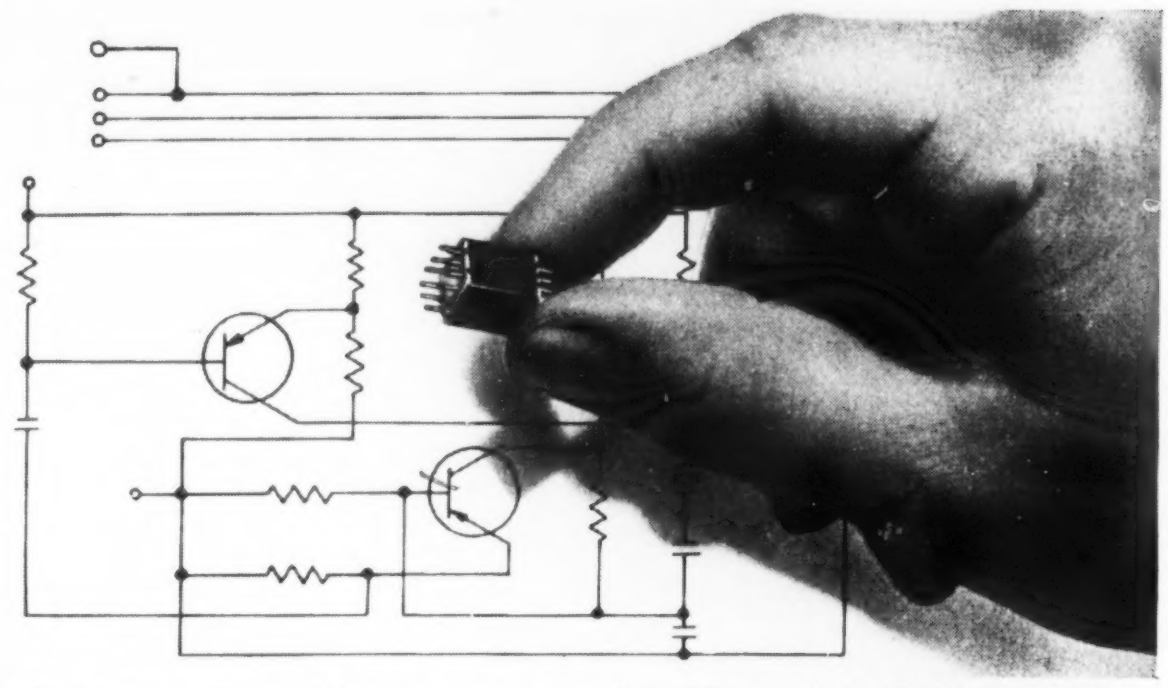
Status Report on RCA Micromodules — dramatic new semiconductor system for high-density parts packaging

Another Way RCA Serves Industry and the Military through Electronics

Now...600,000 Parts Per Cubic Foot In Low-Power Transistor Circuits with RCA Micromodules

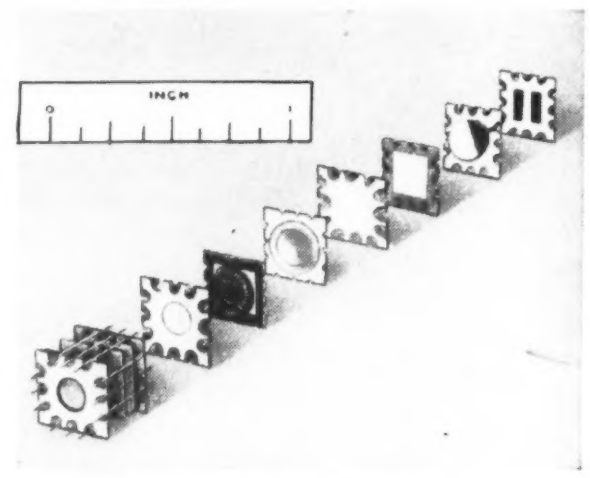
Since our March announcement of the availability of RCA Micromodules, we have been deluged with requests from equipment manufacturers to design their circuits into sample modules...and we are happy to do it, of course. That's the purpose of this first report—to let you know that we'd like to evaluate *your* new or existing circuits for micromodularization. Remember, micromodularized end-equipment for application in military computers, digital devices for missiles and satellites, airborne or portable communication equipment, or submarine electronics is probably only *one design cycle* away. That's why we want you to know *now* what we can do for you.

The inherent advantages of micromodularized equipment are among the most exciting in years. Now in pilot production, RCA Micromodules can be made for *any* low-power transistor circuit. The opportunity to design equipment with a modular parts density of 600,000 per cubic foot means dramatic space savings and makes possible an almost unbelievable number of circuits per cubic foot. Result: greater reliability through redundancy, room to improve accuracy, precision, control, sensitivity, and selectivity. RCA Micromodules are the design engineer's dream come true.



RCA Micromodules make possible equipment with a modular parts density of 600,000 per cubic foot, achievement of dramatic space savings over existing miniature electronic equipment and an amazing increase in the *number of circuit* functions per cubic foot. These advantages provide increased reliability through redundancy, room for more circuits to improve accuracy, precision, control, sensitivity.

RCA Applications Engineers are at work now converting equipment designers' circuits into developmental modules. All customers' circuits are treated in strictest confidence, of course. For some we have standard modules, for others we design circuits. And we are currently developing even more standard circuits. We sincerely believe it will be very much to your advantage to prepare your equipment designs for modularization now. Your RCA Field Representative can get you started. Call him today.



Micromodules were developed in cooperation with the U. S. Army Signal Corps. They are units in which several micro-elements are combined to perform specific circuit functions—amplifier, oscillator, or divider for example. The micro-elements are tiny ceramic wafers approximately 3/10th inch square and 1/100th inch thick, on which conducting, semiconducting, and insulating materials are fused to provide the electrical characteristics of basic electronic components such as resistors, capacitors, and transistors. The elements are interconnected and encapsulated to form Micromodules.

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Panel Discussion

(*Continued from page 47*)

of input go into it. Man, unassisted, could never hope to accomplish such a task. Today, the best source of such assistance comes via large electronic data systems composed of data-sensory, data-transmission, data-processing, and data-display elements. Individually, each of these elements constitutes major technological efforts so that when combined and, in turn, recombined with other related similar elements, the magnitude of the requirement for sound R&D management is almost beyond comprehension. Let us take very simple examples to show to you what I mean and how the results affect military operational philosophy.

Figure 1 represents a factual industrial situation which can be related to a military counterpart. Here, we purport to show a burlap bag-making corporation composed of several bag-making plants. Management has decided on a very elementary form of mechanization to keep track of its production. At each individual worker's position, an operator takes a square piece of burlap, folds it once, sews up two sides and drops it down a chute to the packing room. Normally the floor supervisor would attempt to keep track of production himself and subsequently report to the plant manager who in turn would report to the corporate management. Here, however, something new has been added. As the finished bag goes down the chute it trips a small lever which activates an electronic counter located at the immediate supervisor's desk. This simple procedure holds for all three stations and the summation of these can very obviously be totaled on another counter at a higher level of organization. This immediately relieves the supervisor of one task, perhaps his only one, and allows information to pass to the next higher level of management for immediate control of production. Assuming production to be the major managerial problem, it now appears that the manager may well assign three supervisors to some other job.

Let's now overlay this principle of operation on a typical military organizational chart (Figure 2). The simple lever and counter have been replaced by a reporting and control system many orders-of-magnitude more complex but performing the same general function. Basically, the system consists of data inputs, processing, transmission and display functions. The degree of each of these functions will of course vary with the level of organization concerned and will extend from squadron level to the Headquarters. Formerly, the lower echelons were the only elements having sufficient information upon which to make certain decisions. Now, however, this same information can be relayed instantaneously to higher levels for comparison and over-all decision making. The lower levels are relegated almost to mere housekeeping functions with tactics and employment direction coming from above. Here again, as in the industrial example, we see the level of detailed management going higher and higher in the organization through the employment of electronic data systems.

(Here, the author showed an electromechanical display system which would be provided at Command and Numbered Air Force Headquarters. But, due to security considerations, he did not give a detailed explanation of military utilization of this system. Furthermore, he said, "I strongly suspect that its utilization will change radically as its versatility and performance become more evident.")

Let us now go one step further and look at possible interactions between a number of similar electronic systems each of which is provided to accomplish a particular military job. For example, we have individual electronic data systems under development for weather forecasting, air traffic control, world-wide communications, control of the strategic air fleet, control of air defense operations, etc. It becomes immediately apparent that these individual systems would not function independently but that each may well want data from others and must, in turn, supply data to others. It is this required interconnection that raises the most significant problem of R&D management. The very nature of these systems is such that we cannot wait until they are developed and then provide the required interconnections. Basic factors such as capacity, data rates, bandwidths, to name but a few, must be taken into consideration at the very outset if we are to be successful in total super-system operation.

Two very important points become apparent immediately. *One*, the mammoth complexity of such systems and *two*, the intimate involvement with command decision. There is a very clear relationship between these two, particularly the effect of the second on the first. Associated directly therewith is the requirement for a philosophy of operation which must, in the end, determine the degree of interconnection. Here we have something of another "chicken or the egg" situation. I should like to emphasize that the importance of electronic data systems within the Air Force is not a transient situation. The current status, which accounts for some 50% of the procurement budget, shows no signs of diminishing; so that action in this area becomes increasingly urgent. It is thus easy to see that the problem associated with the management of research and development of electronic data systems is one requiring no "business as usual" procedures. We need a significant educational program and organizational arrangement which will permit an orderly interconnection process.

In summary may I again state that the problems inherent in the management of electronic data systems are not, in the main, within the system entities themselves but lie in the technical and philosophical interconnection of all such systems and their influence on organizational strategy.

PANEL: *Optimum Combination of Man and Machine for Maximum Reliability in Space*

SPEAKER: *Dr. George O. Wright, Aero Medical Lab., Wright Air Development Center*

MANNED SPACE FLIGHT will demand the utmost of both men and machines. Regardless of whether the mission of the space flight system is concerned with reconnaissance, exploration, offensive or defensive capability, success or failure will depend largely on the employment of men and machines in space and on the earth. The design engineers and scientists, recognizing the importance of human factors in system performance, have been hindered by a lack of human factors principles that are applicable to the design of space flight systems. Much the same need has appeared during the design of more conventional weapons systems. However, the needs for space flight are much more critical and urgent.

Complex human engineering problems exist in every phase of space flight from pre-launch through recovery. Perhaps the most dramatic problems concern the space flight vehicle itself. Kinematic analysis reveals the critical control problems

(*Continued on page 64*)

Precision Tracking Beyond The Ionosphere

With the advent of more powerful and longer range missiles traveling at much higher speeds came the need for a new tracking system . . . one with precise stability to measure the velocity and position of guided missiles in the regions of space beyond the ionosphere. The answer was the UHF UDOP system. UDOP transmitters manufactured by Gates are now in use tracking guided missiles far above the surface of the earth with exact precision.

In addition to UDOP, the Army Ballistics Missile Agency has also called on Gates to build VHF transmitters for the DOVAP system. Used in the same application as UDOP, but at altitudes below the ionosphere, Gates DOVAP transmitters are in operation at many of our country's missile testing sites.

Your inquiries regarding special projects for the military are invited. Let Gates demonstrate its ability to meet your most exacting requirements with speed and accuracy. Contact the Gates Government Contract Division today.

Shown below is the Gates M-5687 Radio Frequency Reference System (UDOP).

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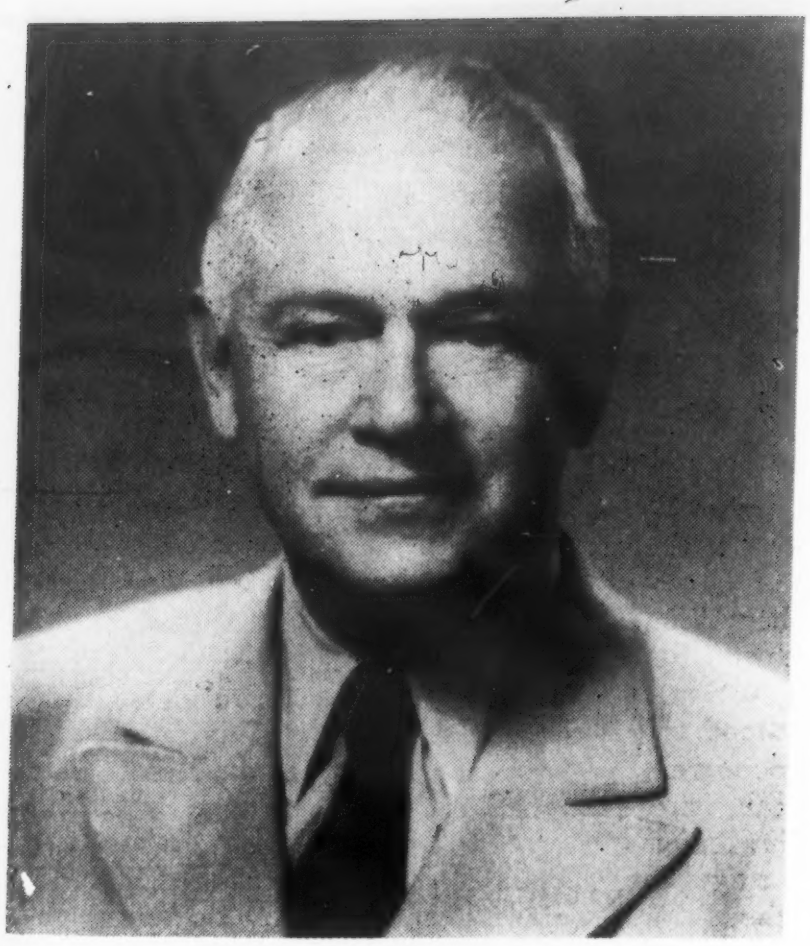

W. J. BAIRD

Colonel, U. S. Army, Ret.
General Manager & Editor

FOR those who have not as yet received my personal letter of thanks, I wish to take this opportunity to express my gratitude and profound appreciation to the many members of AFCEA, industry and military leaders, business associates, press representatives and personal friends for their best wishes and kind and sincere congratulatory messages on the occasion of my added responsibility as General Manager of the Association's National Headquarters.

Considering the months ahead, we have adopted a single word slogan at headquarters, which is service. In this area of service it is my conviction that we should so organize our administrative, editorial, and operational procedures to insure a maximum economy, through modernization, flexibility and cooperation within as well as without our organizational structure. Our successes will be measured within this framework of the policies we employ in meeting this challenge.

During the past several weeks we have been busily engaged in a reorganization plan designed to achieve this objective. We are not reorganizing just for the sake of reorganization (on the new broom sweeps clean adage), nor is it our intent to disrupt the lives of those who have worked loyally and faithfully to support our Association. More precisely our aim is to achieve the full cooperation rather than the disruption of our staff in improving our operational procedures. Our progression must parallel and keep pace with our daily work load and the everyday business at hand. This takes time. We are making recognizable progress and although we have weeks of work ahead, our final results will bear fruit. As evidenced, we have already saved many man-hours of work since embarking on our austerity program. During the period of our reorganization, should any member be inconvenienced in any way, please bear with us, but definitely inform me so corrective steps can be taken immediately.

In brief we are concentrating our fire in order to provide better and more recognizable service to our Regional Vice Presidents, Chapter Presidents, sustaining, group and individual members. Since the 13th Annual Convention we have received an additional Sustaining Group Membership (we now have two) and five new Group Memberships, and have succeeded in bringing back into the Association four companies previously affiliated but lost for one reason or another.

Finally, we cannot emphasize too strongly the importance of receiving your recommendations and suggestions for the betterment of the Association. In fact we invite your comments for in this way you will assist us in rendering better service.

Under the leadership and guidance of our National President and Executive Committee (the executive agency of the National Directors), plans are now under consideration which indicate a steady and progressive growth potential. Every indication points to an optimistic outlook for the year ahead.

As an example of our forward-looking strategy, the necessary preliminary plans for next year's Convention are already reaching a point of finality. Without any publicity we have received 4 table reservations for next year's social events which will be held on Tuesday, Wednesday, and Thursday, May 24, 25, 26, 1960, at the Sheraton-Park Hotel, Washington, D. C.

AFCEA

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The President, the immediate Past President, the Vice Presidents and the Counsel are ex-officio members of the Board of Directors.
**Executive Committee Member.*

Association affairs

Directors Meeting

National President Benjamin H. Oliver, Jr. has announced that the first meeting of the Board of Directors will take place September 17 in Washington, D. C. Directors, Regional Vice Presidents and National Headquarters Officers will attend.

A budget report for the current Association fiscal year will be presented, and 1960 Convention plans will be discussed. Also on the agenda will be suggestions of methods for increasing individual and group memberships and discussion on the advisability of setting up Allied life memberships.

A complete report of the actions taken at the meeting will be carried in a future issue of SIGNAL.

Ham Directory Supplement

Listing call letters for Arizona and California, a six-page supplement to the AFCEA Ham Directory is now available. Copies may be obtained from Ray Meyers, AFCEA Regional Vice President, 717 Anderson Way, San Gabriel, Calif.

New York Telephone New Sustaining Member

The New York Telephone Company recently has transferred from group membership in AFCEA to sustaining membership. The company has named the following to full membership in the Association: B. H. Oliver, Jr., Vice President for Upstate New York and National President, AFCEA; R. M. Burke, A. J. Carey, J. J. Collins, S. W. Cooper, H. W. DeWitt, J. E. Drum, P. O. Gunsalus, A. S. Mayo, A. L. Rumsey, N. A. Warner, and K. J. Whalen, Assistant Vice Presidents; G. J. Carmichael, J. E. Clark, J. D. deButts, E. G. Guillet, M. A. Mace, E. M. Pastore, R. W. Scofield, and J. E. Wilson, General Managers; J. J. Murphy and A. M. Rouse, General Coml. Managers; W. T. Carter, General Mil. Comm. Supervisor; H. R. Bang, J. J. McGeeney, General Plant Managers; R. F. O'Pray, General Sales Manager; B. H. Nelson, J. D. Furman, General Traffic Managers; C. W. Getz, Division Traffic Supt.; A. P. Hammel, D. P. Fullerton, Chief Engineers; T. Brown, IV, Special Services Supervisor.

McCoy Electronics Company

McCoy Electronics Company, a manufacturing firm located in Mount Holly Springs, Pa., is a new group member.

Company representatives in AFCEA are: L. W. McCoy, President; G. K. Bistline, Jr., Chief Engineer; J. E. Stine, Engineer; E. P. Boise, Filter Engineer; D. B. Jacoby, Sales Manager; F. M. Clepper, Engineer; R. D. Pompeo, Engineer; R. E. Clark, Engineer; D. E. Kutz, Secretary and Plant Superintendent; S. Thayer, Crystal Engineer.

Can you answer these questions affirmatively? Have you moved recently? Are you planning to move soon? Did you notify AFCEA of your new address? If you can, read no further. However, if you have moved or are planning to move soon and have not sent your change of address to us, please do so. Send your notice to:

AFCEA
1624 Eye Street, N.W.
Washington 6, D. C.

In Memoriam

Rear Admiral William B. Ammon, USN, Deputy Commandant, National War College and a former national officer of AFCEA, died on August 16.

A graduate of the U. S. Naval Academy, class of 1923, Admiral Ammon devoted a large part of his career to naval communications. In 1952, he became a vice president and national director of AFCEA when he was named Director, Naval Communications. He resigned his official position with the Association in 1955 to assume command of Battleship Division 2 in the Atlantic Fleet.

Dr. Russell H. Varian, Chairman of the Board of Varian Associates, Palo Alto, California, died July 28 of a heart attack.

A graduate of Stanford University, Dr. Varian attained distinction as a scientist in 1939 when he and his brother Sigurd invented the klystron, the device which led to the development of effective radar.

In 1948, Dr. Varian, Sigurd, and four others founded Varian Associates. The firm, devoted to research and manufacturing in specialized fields of electronics and applied physics has grown from six employees to more than 2,700.

NEW MEMBERS

Listed below are new members of the AFCEA who have joined the Association during the month of July. Members are listed under the Chapter with which they are affiliated. The August listing will appear in the October issue.

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Carl N. Shipman

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Robert H. Stone
William L. Guyton
William E. Cory
David J. Morrisey

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Capt. Thomas J. Gwin
Pvt. Warner E. Eskew
Sgt. Billy R. Shelton
William H. Connell
Emmett B. Selman
CWO Fred L. Haskell
Capt. James T. Langston
M-Sgt. William B. Britten
M-Sgt. Martin Murphy
Sgt. Olin D. Cromer
M-Sgt. John D. McCollum, Jr.
M-Sgt. Edsel H. Flanders
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Capt. James F. Blake
Capt. Richard P. Grey
1st Lt. Jerry C. Shaufelberger
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Alexander Beebe
A-2C Paul L. Volosky
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Charles A. Jolley, Jr.

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Culver C. Gorsuch

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Arthur J. Schwartz
Jean Y. LeRoy
Gordon A. Stocker

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George K. Bistline, Jr.
James E. Stine
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Harry W. Kenny
Walter F. Bell, Jr.
Edgar M. Corson

Pittsburgh
Joe S. Hitt
Kenneth C. Johnson

Rocky Mountain
James F. Edwards

Rome (Italy)
Bruno Alberto
Lucio Maiello
Pasquale Tattoli
Elena Rota
Luigi Ruggiero
Giovanni Albarella
Sergio Tosca
Enzo Tavolato
Gennaro Santomauro
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Arthur N. Clark
Kenneth T. Larkin
Frank Mansur

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The Association takes great pleasure in announcing the names of the winners of the Armed Forces Communications and Electronics Association Gold Medal Honor Awards. These medals are awarded annually to outstanding senior Army ROTC, Navy ROTC, and Air Force ROTC students majoring in Electrical Engineering. Selection is made by the Military Staff and the Dean of Engineering of the respective university or college. Some of the criteria for selection include proficiency in education and leadership, moral character, and participation in recognized campus activities—all to a high degree.

In addition to the Gold Medal, the award includes a certificate, a year's membership in AFCEA, and a subscription to SIGNAL Magazine, the official journal of the Association.

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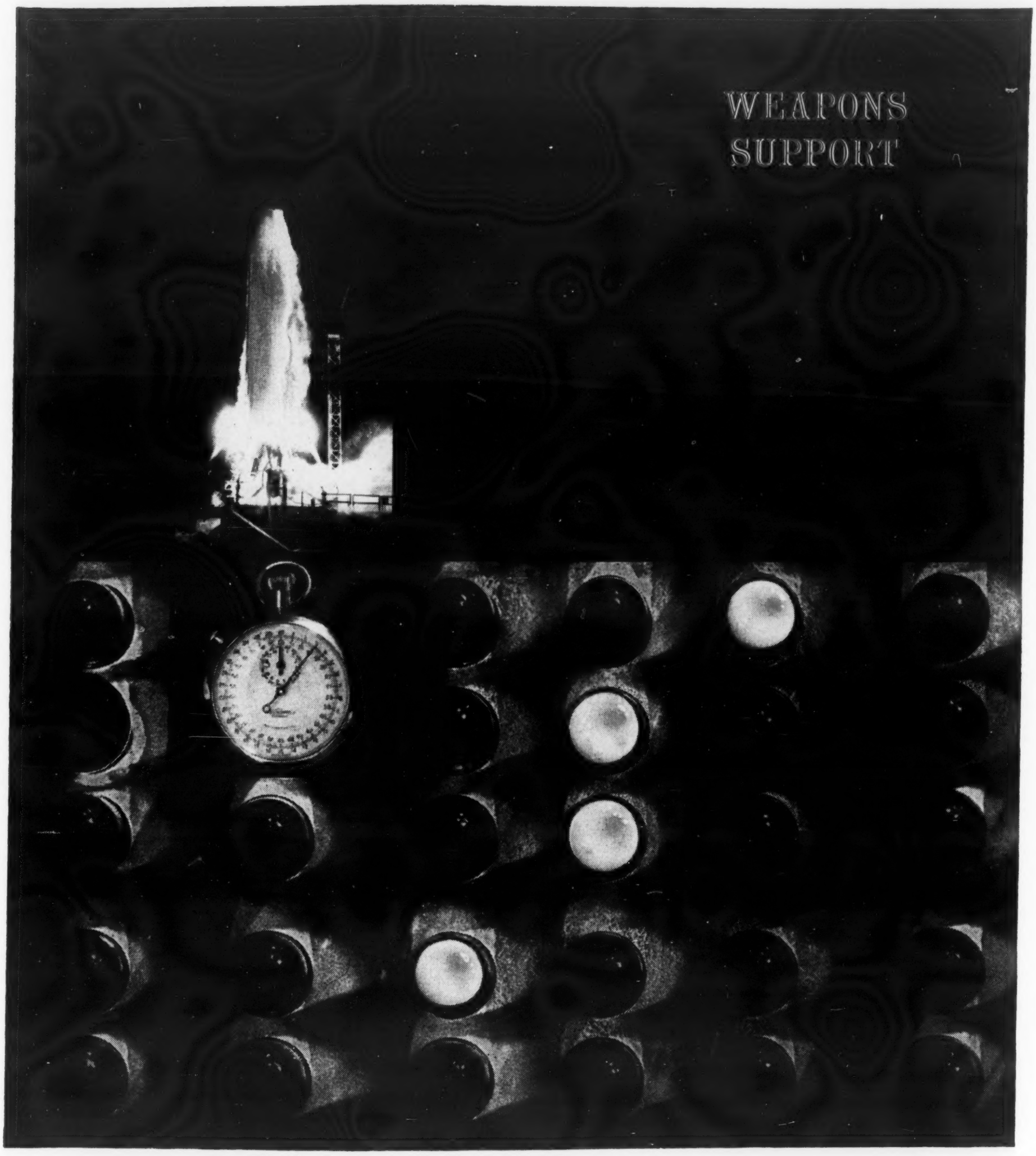

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SWITZERLAND: Pres.—Capt. Gerald C. Gross, USNR, Intl. Telecommunications Union, Geneva. Sec.—Robert V. Lindsey, Intl. Telecommunications Union, Geneva.

TINKER-OKLAHOMA CITY: Pres.—Lt. Col. George L. Timme, Jr., GEEIA Rgn., Tinker AFB, Okla. Sec.—Maj. John L. Whyatt, 3rd AACS Sqdn. (Mob), Tinker AFB.

TOKYO: Pres.—Capt. Frank A. Dingfelder, Staff, Cdr. Naval Forces Japan, FPO S. F., Cal. Sec.—Cdr. Harold B. Kirkham, Naval Comm. Facility, Navy 830, Box 20, FPO, S. F.

WASHINGTON: Pres.—A. W. Christopher, Sylvania Electric, 734 15th St., N.W., Washington, D. C. Sec.—H. R. Hartsough, AT&T Co., 1001 Connecticut Ave., N.W., Washington, D. C.

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Chapter News

Augusta—Fort Gordon

On July 17, the Augusta-Fort Gordon chapter held its summer dinner-dance at the Fort Gordon Officers Open Mess. The affair was attended by approximately 100 members and guests.

Chicago

At a recent meeting of the chapter, the following officers and board of directors were elected for 1959-1960: president—William L. McGuire, Vice President, Automatic Electric Co.; vice presidents—Arthur J. Schmitt, President, Amphenol Electronics Corp., Carrington H. Stone, Carrington H. Stone, Engineers & Exporters, James Weldon, Mid-Western Regional Office, U. S. Army Signal Supply Agency; secretary-treasurer—Sanford H. Levey, Vice President, Allied Radio Corporation; Board of Directors—Col. Carl Cuphaver, Mid-Western Regional Office, U. S. Army Signal Supply Agency; Walter H. Flinn, General Security Mgr., Illinois Bell Telephone Co.; Raymond K. Fried, Feinberg & Freid, (General Counsel-Chicago chapter); Capt. H. J. Goldberg, USN, Electronics Supply Office; Robert F. Halligan, Vice President, Hallicrafters Co.; A. P. Lancaster, Vice President, Western Electric Co.; Thomas J. Lloyd, Vice President Admiral Corp.; Col. Albert J. Mandelbaum, Signal Officer, U. S. Fifth Army; Henry J. McDonald, Secretary & General Counsel, Kellogg Switchboard Supply Co.; David S. McNally, Vice President, Kleinschmidt Labs, Inc.; Walter H. Pagenkopf, Vice President—Manufacture, Teletype Corp.; L. A. Pereira, President, L. A. Pereira & Co.; Everett F. Wagner, Asst. Vice President, Bell & Howell; W. S. Wheeler, Vice President, Motorola, Inc.; Col. Donald M. Wright, Chief, Chicago Air Procurement District USAF.

As the main feature of the June 25th meeting, Captain F. L. Pinney, Jr., USN, Deputy Director of Special Projects Office, Washington, D. C., presented an illustrated lecture and movies on the planning, development and operation of the Fleet Ballistic Missile Weapon System.

Augusta-Ft. Gordon—Richard B. Sheridan, North Augusta High School graduate, receives AFCEA's annual Science Senior Award from Col. Robert R. Creighton, Asst. Commandant of the Army's Southeastern Signal School.

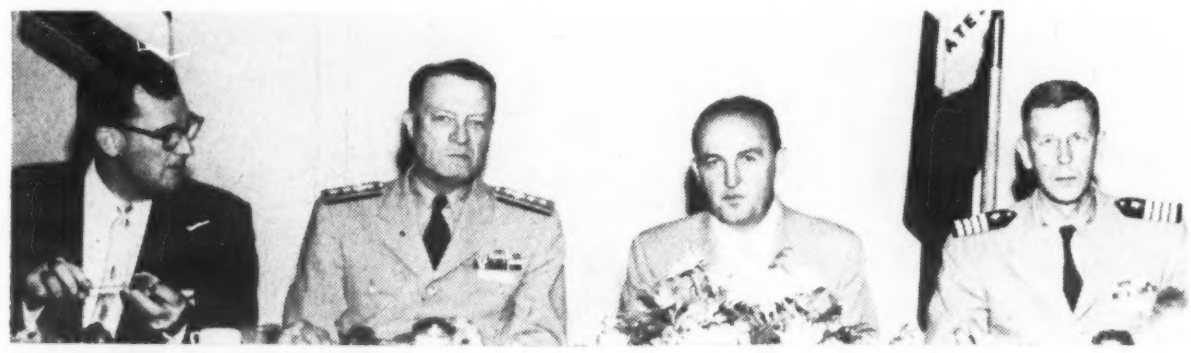
The Director of Sales for Paraplegics Mfg. Co. (PAMCO), Harry Bendtsen, Franklin Park, Ill., also gave a short talk on how handicapped persons employed by PAMCO participate in the nation's missile program.

Rear Admiral E. P. Forrestel, USN, Commandant of the Ninth Naval District, was guest of honor at the meeting where 156 members and guests were present. The session concluded with a tour through the newly installed Rapid Data Transmission System and the UNIVAC areas in ESO.

Hawaii

The annual election dinner-meeting for the Hawaiian chapter was held on May 7. The following officers were nominated and unanimously elected: president — Robert Lowrey, Hawaiian Telephone Co.; first vice president—Brig. Gen. Stuart S. Hoff, U. S. Army; second vice president — Capt. Mann Hamm, U. S. Navy; third vice president —Col. S. A. Mundell, U. S. Air Force; Secretary—Francis Medeiros, Hawaiian Telephone Co.; treasurer—Della Pennington, U. S. Navy; National Council Rep.—Capt. J. F. Dalton, U. S. Navy.

The May 9 meeting of the chapter, sponsored by the Air Force, included a presentation on the Air Force missile program and a most interesting and extensive tour of its Kaena Point tracking station.



Chicago—L to R: W. H. Flinn, Illinois Bell Telephone Co., Chicago; RAdm. E. P. Forrestel, Commandant of the Ninth Naval District and guest of honor; H. J. McDonald, Sec. and General Counsel for Kellogg Switchboard and Supply Co., Chicago, and Capt. F. L. Pinney, USN, Deputy Director of Special Projects Office, Washington, D. C., and guest speaker.

London

The London chapter met at the Columbia Club Hotel on June 15 for its annual general business meeting and election of officers for the coming year. After the election and dinner, two color films on missile technology were shown to the members and their guests.

The following officers were elected for the 1959-60 term: president—Col. Joseph A. Plihal, Hqs., 3rd Air Force (30CE), APO 125, N.Y., N. Y.; vice presidents—Maj. C. L. Bachtel, USA; Capt. R. Hay, USN; Col. A. H. Snider, USAF; Cdr. C. G. Mayer, USNR; Maj. W. H. Fritz, USA; associate vice presidents—Sir Harold Bishop, BBC; Henry Chisholm, A.C. Cosser, Ltd.; Maj. Gen. Eric S. Cole, Director of Telecommunications, The War Office, London; Henry G. A. Kay, Benjamin Electric Co., Lad.; Sir Reginald Payne-Gallwey, BART; treasurer-Cdr. R. W. Hyde, USN; associate treasurer—P. D. Canning, The Plessey Co., Ltd.; secretary—Lt. Col. Richard F. Amann, USAF; associate secretary—L. T. Hinton, Standard Tel. & Cables, Ltd.

New York

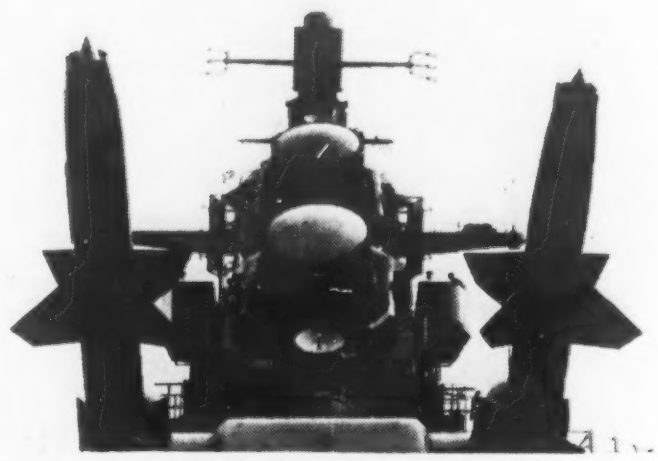
The Officers Club on Governors Island was the scene of the June 17 meeting which provided cocktails, a buffet supper and dancing until 11:00 p.m.

North Carolina

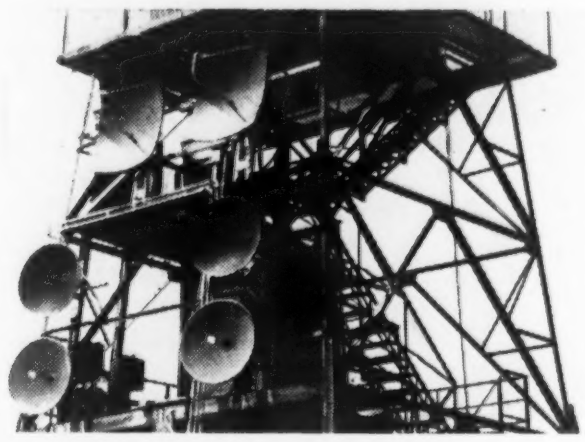
An informal talk on the organization, history and aims of AFCEA by Major General Ralph T. Nelson, Chief Signal Officer, USA, highlighted the June 15th dinner-meeting of the North Carolina chapter. General Nelson spoke before 134 persons in the Lafayette Room of the Fort Bragg Officers Open Mess.

Montgomery—President of the Montgomery chapter, Lt. Col. Herbert Herman, Communications & Electronics Doctrinal Div., Air Command and Staff College, Maxwell Air Force Base (left), and chapter vice president H. B. Lackey, Asst. Vice President, Southern Bell Tel. & Tel. Co., Birmingham (right).

FIERY GASES glow as Sperry scientist studies magneto-hydrodynamic characteristics of molecules subjected to high current discharge. From this advanced basic plasma research will come microwave energy much more powerful than is now available and will perhaps explain the generation of microwaves by the sun and other galactic bodies.

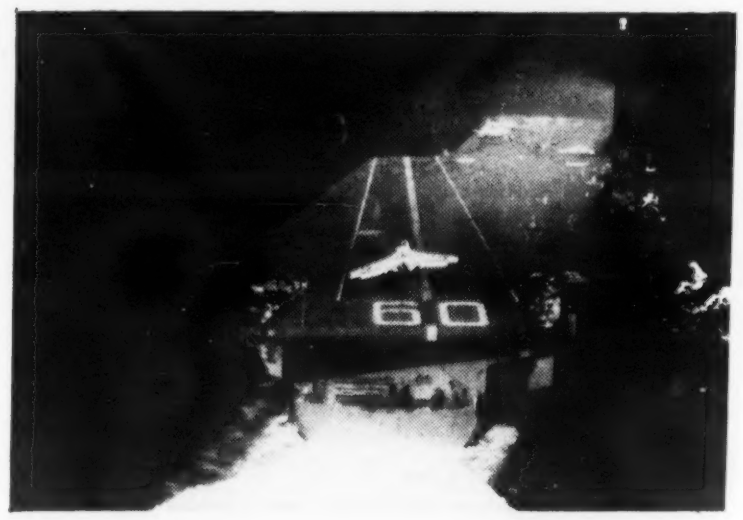


RESEMBLING SEARCHLIGHTS—radars aboard cruiser *USS Galveston* depend on power from Sperry microwave tubes to launch and guide Navy's Talos missiles on precise course at supersonic speeds.



WORDS OR PICTURES are beamed cross country by microwave relays eliminating wires and damage from storms. Western Union system using Sperry microwave tubes handles up to 2,000 messages simultaneously.

NAVY CARRIER PLANE finds "home" by flying precise guidance signals powered by Sperry microwave tubes in TACAN, tactical air navigation system. (U.S. Navy photo.)



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Twenty years ago a group of Sperry engineers began development of odd-looking devices to generate microwave energy. In doing so a new field of science was established—and the world gained a new and previously unharnessed power.

Modern radar, for example, owes its ability to "see" through fog and storm to microwave tubes which beam signals to distant objects—and with such precision that returning signals form distinct images on the radarscope. Communications, national defense, entertainment—even food preservation—all have benefited from the ability to create and control this new power.

Radio astronomy—another new science—now reveals that the sun and other galactic bodies generate microwave energy—and probably have done so since the formation of the universe. Sperry's research of this solar microwave energy may permit radically new types of generators which will lead to a better understanding of outer space.

If you are interested in microwave tubes for any purpose, write Sperry Electronic Tube Division, Sperry Rand Corporation at either of its two modern plants—in Great Neck, New York and in Gainesville, Florida.

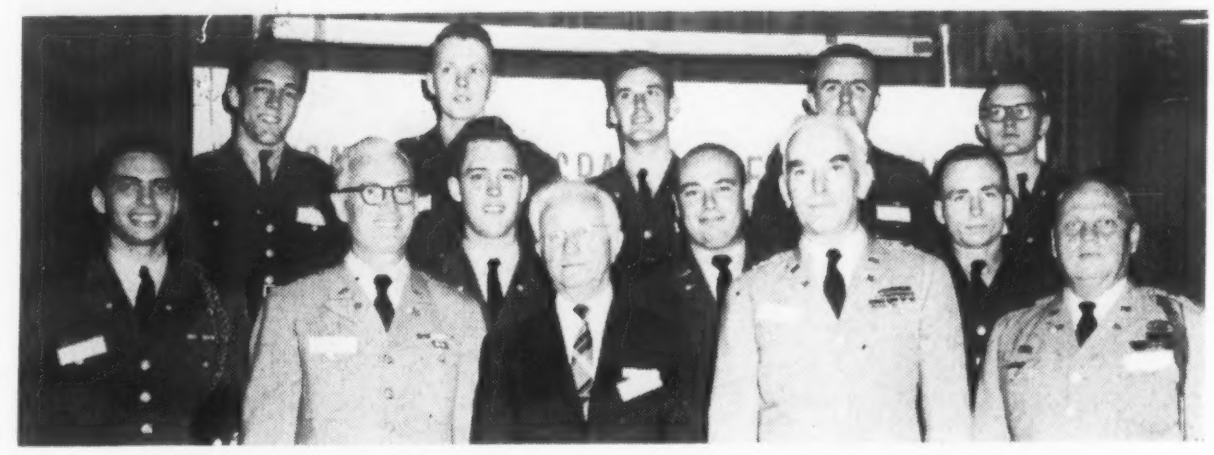
SPERRY

Special guests included Major General Robert F. Sink, Commanding General XVIII Airborne Corps and Fort Bragg, Mrs. Sink and Mrs. Nelson.

Orange

The election of chapter officers took place at the May 28th dinner-meeting held at Pearce's Restaurant. Chosen for the 1959-1960 term were: president—Major Morris Muse, USAF; 1st vice president—Vincent Meder, Radiation, Inc.; 2nd vice president—Col. Carroll Miller, Wilcox Electric Co.; 3rd vice president—Capt. William Rooney, Martin, Orlando; 4th vice president—Col. William S. Marks, Jr., USAF; secretary.—Lt. Col. James A. Trutter, Radiation, Inc.; treasurer—Ray Weaver, Minute Maid Corp.

The program featured a most interesting talk by Major William Elliott from Hqs., Air Rescue Service, USAF, Orlando Air Force Base. Major Elliott gave a history of the ARS and presented a color film covering its world-wide scope. Mr. Kelly Moseley, Regional Vice President of AFCEA and Asst. Vice President of Southern Bell Tel. & Tel. Co., also gave a short talk and met informally with the officers elected for the next term.



Northeastern University—Members of the Northeastern student chapter who attended the AFCEA convention in June, with panel moderator, Dr. A. B. Butts (center), and Maj. Gen. Ralph T. Nelson, Signal Officer, USA (second from right).

Rome-Utica—Pictured are the newly elected officers of the chapter. L. to R: Maj. Joseph R. Bernard, 3rd vice president; Lt. Col. Michael Bobella, 1st vice president; Murray Socolof, president; Albert F. Wild, 2nd vice president; Robert F. Weil, Secretary, and Charles A. Strom, Jr., historian.

Paris

The following officers were elected for the term of 1959-60: president—Rear Adm. Henry C. Bruton, Hqs., US EUCOM C-E, APO 128, N. Y., N. Y.; vice presidents—Maj. Gen. C. Rodney Smith, I.S.E. and A. de Bondini, Automatic Electric Int'l., Inc.; honorary vice presidents—Dr. E. M. Deloraine, Tech. Dir., I.T.T. Co. and Gen. J. M. H. Guèrin, C.A.S.D.N.; G. Rabuteau, Mng. Dir., Le Materiel Tel. Co.; Maurice Jean, Dir. (Grp. Electronic) Co. Francaise T. H.; Vice Adm. Maurice Conge, C.C.T.U.; Dr. Maurice J. H. Ponte, C.S.F.; past president — Maj. Gen. Victor Conrad, Signal Officer, SHAPE; secretary-treasurer — Lt. Col. Phillip H. McCorkle, Hqs. US EUCOM (Comm-Elect), APO 128, N. Y., N. Y.; directors—Col. Adrian H. de Goede, Mgr., Int. General Electric Co.; Joseph R. Pernice, European Mgr., Collins Radio Corp.; Col. William E. Heltzel, Chief SigO, Allied Land Forces Europe Central; Col. John Hessel, NATO; Maj. Gen. Joanny M. E. Schott, Allied Land Forces Central Europe; Georges P. Chevigny, I.S.E.; Marcel V. Laveran, Company Francaise Thomson-Houston; Maurice Vidrequin, T.R.T.; Roger A. Aubert, C.S.F.; Louis Henry, S.A.T.; Col. Jacques Debré, Groupe C.I.T.

Pittsburgh

The Pittsburgh chapter met at Pat McBride's on June 19 for the annual meeting and dinner party. 65 members and guests were present.

After dinner, Mr. Ridley, the outgoing president, introduced the new officers and gave a report on the National Convention which he had attended. After the door prizes were given out, music and entertainment were enjoyed by all for the rest of the evening.

San Juan

Members of the EIA were guests at the June 25th meeting held at the Officers Club, Fort Brook. The meeting featured a speech by Mr. Walter Serniuk, Mgr. of Amherst Engineering Laboratory, a division of Sylvania Electric Products, Inc. Mr. Serniuk's speech was called *The Challenge of Modern Electronics* and covered new developments in communications and electronics. His talk was interspersed with camera slides which drew much discussion from members and guests after its conclusion.

Santa Barbara

El Presidio Restaurante was the scene of the June 19th meeting of the chapter. Following the election of Messrs. Murray, Redemske and Sayovitz as chapter directors, Ray Meyers, and Mr. Redemske commented on their impressions of the National Convention. Mr. Meyers, Dr. Sayovitz and Admiral Murray all stressed the importance of youth and education in various fields. Cdr. Hearn pointed out the increasing awareness by the public of electronics and then presented two colored films depicting the role of the Armed Forces in the IGY rocket program and the construction of Fort Churchill in the Hudson Bay Region of Canada.

(Continued on page 80)

San Juan—RAdm. Frank Virden, USN (far right), Assistant Chief of Naval Operations and Director, Naval Communications, addresses the San Juan chapter at a recent meeting.

Because of its wonderful simplicity, more and more governmental and business organizations are converting to Single Sideband communications systems by Eldico. In addition to the recognized advantages of SSB—far greater range, increased intelligibility, and a smaller package—Eldico equipment is engineered for pre-eminence in every way.

A case in point is the Eldico S-100 system, whose 100 watts minimum peak envelope power is equivalent to approximately 400 watts in AM gear. Use is greatly simplified by Eldico's preset channel selector, which requires no tuning by the operator. Only three "set and forget" controls are needed for operation, and optional remote features permit functioning up to five miles away. Thanks to Eldico's antenna tuner, only one antenna is necessary.

Faster communication is enabled by this true duplex system, with independent receiver and transmitter. It's supremely versatile, too, as the S-100 can be used in *all* modes of operation: SSB, AM, CW, and—with auxiliary gear—teletype.

The compact unit, which includes a microphone bias supply, is designed for easy servicing. Best of all, the Eldico S-100 is compatible with your existing equipment. Conversion to this advanced apparatus may be as gradual or prompt as you wish!

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Panel Discussion

(*Continued from page 49*)

that exist in order for the vehicle to be placed in an orbit about the earth, or to be started on the proper path that leads to a more distant objective. The role of human operator (on the ground or in the vehicle) in attaining orbits and paths has been questioned many times: Can a man perform or assist in performing such functions? If so, what data will be required? What responses should be made? Even if the instrumentation problems for automatic course attainment are completely solved, other functions will be assigned to the man so that there will remain the question of how to use the human effectively. Moreover, even if the functions required for navigation, defense or evasion, communication, return, re-entry and recovery are automatized, human engineering questions concerning the task and workspace for the man will remain critical. For example, there is the question of whether the operator is to serve analogously to present day pilots (i.e., as complex decision makers) or analogously to flight engineers (i.e., as equipment monitors and repair men). In the space flight system, there are the options of controlling the vehicle remotely from the ground, programming the control functions into a machine, or of providing for control by the pilot. As a consequence of these options, questions must be answered concerning which mode of control can override the others and under what circumstances. Also, decisions about the optimum distribution of control functions among the various modes of control must be made.

Less dramatic and more familiar problems exist on the ground. Considerable work has been done in eliminating equipment failures; however, human errors in the erecting, servicing, and checkout of space vehicles probably will be much the same as in ICBM missiles. Such factors in missiles have not been studied in a systems framework. For example, the tasks assigned to men and machines in the "block-house" during checkout, pre-launch and launch of surface-to-surface type missiles should be restudied with the idea of reaching some optimum allocation in future designs based on over-all systems measures.

Finally, there are problems concerning the integrated operation of the men and machine in space with the men and machines on the earth. The simplest of these problems arise in tracking and communicating with a simple manned satellite. The problems become more complicated in the case of manned space reconnaissance vehicles, and most difficult where interplanetary space is considered. Now the key question we ask today is how to arrange men and machines for maximum reliability. This, and indeed all of the broad, complex human engineering problems are symptomatic of a more basic problem: *the lack of adequate methodology.* First, there exist only primitive and non-systematic methods with which existing and proposed systems can be analyzed so as to highlight human factors problems. (The lack of techniques for the human factors analysis of man-machine systems appears more prominently in the case of proposed systems.) Second, there is only the most fragmentary of methodologies for the integration or development of human factors principles and information *within a systems framework.* On the one hand, there is a great body of human engineering data that is potentially applicable to the design of space flight systems. More is known today than ever before about the display and acceptance of information, the human being as an element in a control loop, and the performance of the human operator in unusual environments. On the other hand, there is no comprehensive method, or set of methods, available for incorporating such scientific information into system design. In addition, gaps are appearing in the knowledge available at the present, and in that which will be available in the future. These gaps become apparent when attempts are made to integrate diverse findings and approaches into a set of system design principles, and in this respect are attributable to the fundamental lack of methodology.

It is, therefore, the purpose of this paper to suggest one method for conducting systems analysis, namely, the use of stochastic matrices. In this method we enumerate a defined set of states, cast them into matrix notation, and subsequently perform matrix transformations based on a selected set of variables of interest.

Let us, for the purposes of illustration, consider the reliability problem in man-machine systems. First we enumerate four states, e.g., (1) trivial failures, (2) deteriorating failures, (3) catastrophic failures, and (4) no failures. We then construct a four-by-four matrix in which the cell entries are the probabilities that the system will go from one state to another. For example, at the intersection of the *no failure* row and the *catastrophic failure* column an entry would be made, say Pr = 0.3. This would indicate that the probability of the equipment observed in a state of no failure would go to the state of catastrophic failure on the average of 3 times out of 10 units of observation. This matrix will be called the *operational matrix,* P, and its cell entries would be made up of observational or simulation data.

The next step is the construction of an *ideal matrix,* P′, in which the cell entries would be probabilities of changes of failure states associated with optimum reliability properties. The task then to be performed is the solution of the transformation equation, $T(P) = (P')$ for T. This matrix, T, represents the conditions under which the operational matrix can be made into the ideal matrix. The investigator can then translate the matrix ,T, into the variables of interest, say, the maintenance procedures and the analytic scheme is complete.

Subsequent steps in the application of this method for systems analysis will depend on the orientation of the investigator. Our particular disposition is to follow the matrix analysis with a comprehensive simulation program for the further refinement of the matrices and also for the generation of systems design data.

One other aspect of the utility of the matrix method is the possibility of computing the entropy of each matrix. With this powerful tool the investigator can examine the impact of his efforts to continuously reduce the entropy of his system. Stated another way, the investigator constantly has a guide for striving towards conditions of more and more certainty so that his decisions are easier to make. It is very often true that the difficult decisions are those which have to be made under conditions of uncertainty.

It remains only to indicate in a general way the constraints and assumptions under which this method of matrix analysis can be used. First, it is necessary to assume that the aspect of the man-machine system under investigations is a Markov chain. This implies that the contingent probabilities can be specified. These contingent probabilities are the matrix cell entries. Second, the matrix must be stochastic, that is to say, each row must sum to one. Finally, the probability distribution for the initial condition of the system must be known or postulated. In general, these requirements can be met without doing too much violence to real-life situations. At any event, the merits of the analytic scheme would seem to outweigh the difficulty of meeting the assumption.

Spencer Laboratory is named for Raytheon's Senior Vice-president, Percy L. Spencer, a pioneer in tube development.

Spencer Laboratory, the newest and most modern research and development laboratory for the design of all types of microwave tubes, has been put into operation at Burlington, Massachusetts by Raytheon.

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Infrared

(*Continued from page* 45)

limited to optical or line-of-sight range and are affected by atmospheric conditions, their importance lies in their *passive* nature of operation.

IR sensory units and devices operate entirely without the knowledge of the subject target—whether personnel, vehicles, or other heat-emitting objects within range of the equipment.

Also, IR sensory units function effectively in darkness—making them especially useful at night as passive detection devices.

Airborne Sensory Units

In the second principal category of Signal Corps participation—airborne IR sensory units—a greater effort is being expended, primarily because of the urgent need for suitable surveillance equipment for use aboard all types of Army aircraft—particularly fixed-wing airplanes and surveillance drones.

Like all types of IR sensory devices, airborne units are affected adversely by atmospheric conditions. Their redeeming and important feature is that they are passive in operation.

Although aircraft may be equipped with photographic sensors and/or radar equipment, only IR sensory units can detect heat-emitting targets regardless of camouflage. For this reason, IR devices are often used *to supplement* radar, photographic, and other sensory units. Exceptions are airborne passive missions at night, which preclude the use of radar, photographic, and similar types of sensory devices, and which utilize *only* IR sensory units.

Equipment Development

Four or five airborne IR equipments are under development by the Army Signal Corps, each differing mainly in configuration, weight of equipment and method of data presentation.

Current objectives are to obtain improved scanners, better resolution, and smaller size and weight of equipment.

In achieving better resolution, the Signal Corps seeks to obtain a quality approaching that of conventional photography.

Size and weight of IR sensory units are of particular significance in airborne applications. Early models of IR equipment weighed about 500 pounds. The Signal Corps is now seeking weights ranging from about 250 pounds to, in some cases, less than 100 pounds—with corresponding decreases in physical size and volume of airborne IR units.

In these two principal areas of military IR application—ground-based intrusion detection devices and, *particularly*, airborne IR sensory units—research, design, and development by the Signal Corps and its industrial contractors continue with the singular objective of providing the Army with an absolute surveillance capability utilizing infrared technology.

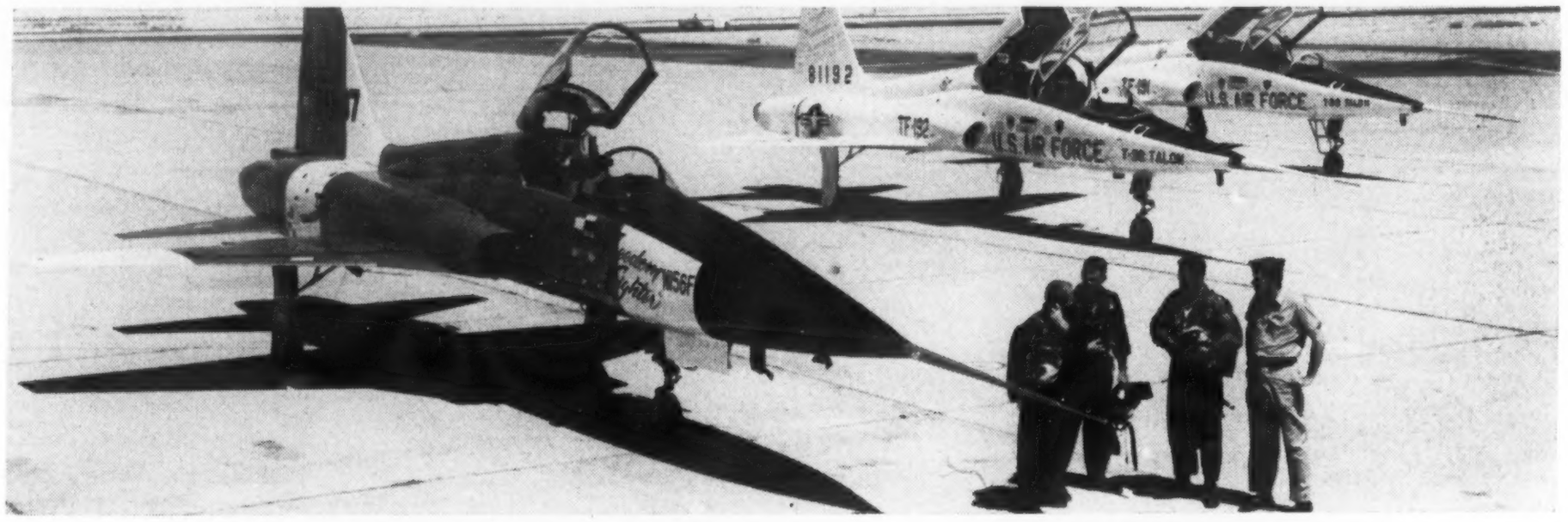
ANOTHER WAY RCA
SERVES INDUSTRY
THROUGH
ELECTRONICS

RCA Electronics introduces the tube of tomorrow

Called the Nuvistor, this thimble-size electron tube is likely to start a revolution in electronics. RCA engineers scrapped old ideas—took a fresh look at tube design. The result will be tubes that are far smaller, perform more efficiently, use less power, can take more punishment, are more reliable. Developmental models now being tried out by designers will have a profound effect on the size, appearance, and performance of electronic equipment for entertainment, communications, defense, and industry in the future. It is another example of the way RCA is constantly advancing in electronics.

RADIO CORPORATION OF AMERICA

NEWS ITEMS AND NEW PRODUCTS



Shown above at Edwards Air Force Base in California are fighter and trainer members of Northrop Corporation's new supersonic manned aircraft family. The new multipurpose N-156F Freedom Fighter, shown in foreground, was scheduled to begin test flights last July. The N-156F, similar in basic design to the USAF's T-38 Talon supersonic trainer, shown in background, is being developed by NORAIR Division of Northrop under Department of Defense contract for use by U. S. allies. The T-38's have completed over 50 flights since testing began.

☆

On April 6, 1959, Donald S. Parris, Director, Electronics Division, Business and Defense Services Administration of the Department of Commerce, called a special meeting at which representatives of industry were invited to express their views on material needed for efficient American production. These representatives met with Defense and other governmental officials and their views are incorporated in a new document recently released.

BDSA is to be congratulated for its forward approach in inviting the representatives of the Electronics Industry to participate in the discussion on current materials necessary in keeping American production moving forward. It is a refreshing approach to provide our industries this opportunity in the promulgation of the new document.

The Defense Materials System, commonly referred to as DMS, is designed for efficiency and ease of work. The new system relieves the subcontractor of any worry about materials for current production by having only the prime contractor apply for necessary materials. The prime contractor, therefore, makes known his demand, gets his allocation and makes his allocation to the sub-contractor. Life is made easier for all concerned, and only one set of books becomes necessary for record purposes.

DMS is not a to be confused with the present Presidential-directed program of minimum and maximum stockpiling of materials for a national emergency. It applies only to satisfying the demand for current production.

• • •

A portable Flexographic printing press has been developed by Sohn Manufacturing, Inc., of Plymouth, Wisc.

The machine measures 9 x 9 x 9 inches, without guard case and weighs 40 pounds. It is reported capable of printing and die cutting on pressure sensitive label paper, or score cutting on gum, heat seal or plain paper; it can print 6,000 labels per hour and change colors and printing plates in seconds.

According to the company, the new development will eliminate huge inventories, obsolete labels, and the holding up of shipments while waiting for labels.

• • •

Passengers on the world's first atomic-powered merchant vessel, the *N. S. Savannah,* launched July 21 at Camden, N. J., will be able to make ship-to-shore calls over a dual radio system.

An official of the Radio Corporation of America disclosed that two RCA Radiotelephone units will be installed on the 21,000 ton vessel and will permit the purser to place passenger ship-to-shore calls directly and also enable the bridge to take over control when the Radiotelephone is needed for official ship's business.

The nuclear "heart" of the *Savannah* will be laid open pictorially by two television cameras so that passengers in the main lounge will be able to see a nuclear reactor producing steam for the ship's conventional turbines. The pulse or "heartbeat" of the reactor also will be relayed over an accompanying audio hookup.

According to RCA, the television picture of the propulsion unit will be transmitted over a closed circuit to a 6-by-8 foot television projection screen in the lounge by means of a switching system in the ship's control center. The cables leading to the cameras will be installed through the chamber wall with a special "potting" process to prevent any radioactivity from seeping out of the containment vessel housing the reactor.

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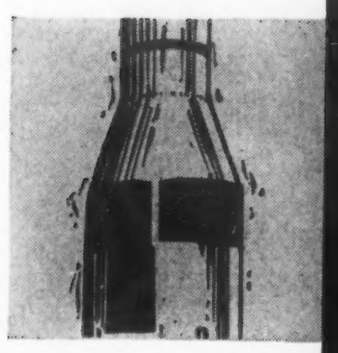
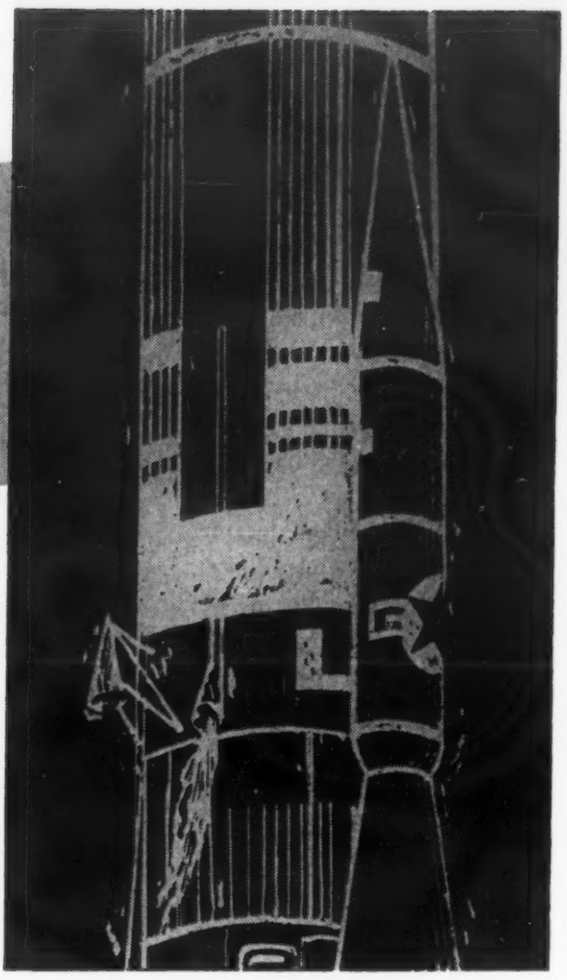
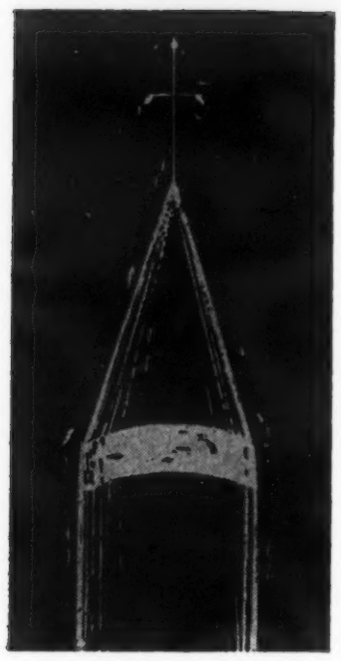
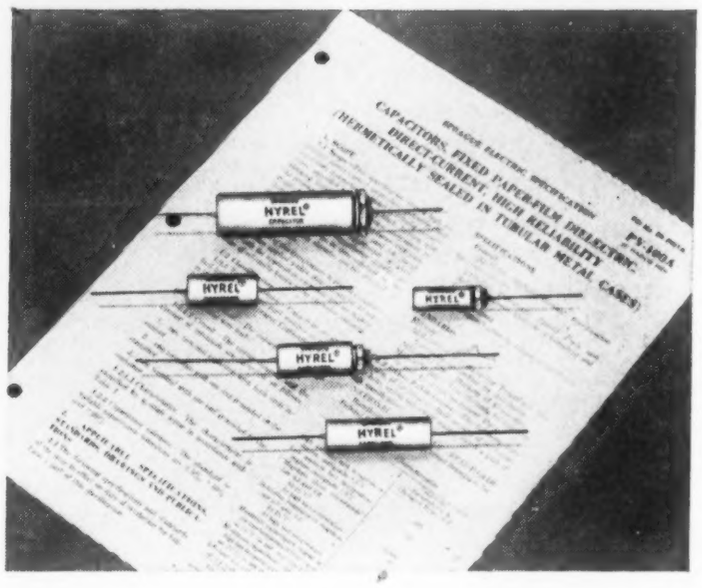
A detailed survey of the present effort to supply U.S. scientists with Russian scientific literature lists 76









MISSILE-READY CAPACITORS

—thanks to Sprague's PV-100A

It has been more than three years since Sprague originated Specification PV-100–*the first high reliability capacitor specification for missiles and other critical applications.* This specification and a later revision, PV-100A, have proved so comprehensive and so successful in providing "the highest order of reliability known to the capacitor industry" that their provisions are currently reflected in *every* military specification covering high reliability capacitors. This is a distinction shared by no other capacitor manufacturer.

The capacitors manufactured by Sprague to PV-100 and PV-100A standards have amassed a record of reliability far in excess of original expectations. On high frequency vibration, shock, and other environmental tests, failure rate has been almost zero. On accelerated life tests (250 hours at 140% rated voltage, 125° C) *failure rate has been less than .05%.* This performance is virtually impossible to beat . . . now and for some years to come. But Sprague doesn't stop here. The company's research on materials, processes, and controls is now more intensive than ever. Sprague knows that only through continuous research can high reliability be made *higher.*

If you're interested in the fine points of high reliability capacitors, call your Sprague District Office or Representative. Or write letterhead request for Sprague's Hyrel Bulletin 2900A and Specification PV-100A to Technical Literature Section, Sprague Electric Company, 287 Marshall Street, North Adams, Mass.

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Soviet journals now available in English.

The survey, released by the National Science Foundation, reports on the sources of Russian scientific literature, its availability in the U.S., and current translation programs of professional and academic groups and government agencies. Current methods of providing comprehensive coverage of untranslated Russian material are also analyzed.

According to this edition, revised and expanded from an earlier one, 2,026 scientific journals and serials are being published in the U.S.S.R. Since 1956, Soviet scientific materials have become increasingly available in the U.S. They are listed in the *Monthly Index of Russian Accessions*, published by the Library of Congress and available from the Government Printing Office.

In considering Soviet information sources, previous concepts of centralization of information-abstracting services in Russia are re-examined by the survey. "Scientific abstracting and other secondary publication activities—like the actual research and primary publishing—are by no means as highly centralized in the U.S.S.R. as many reports circulated in this country suggested. Many institutions carry on fairly extensive scientific information programs in their own specialized fields just as do research laboratories, industries, and universities here," it reports.

Long-standing interest in foreign science information by the Soviets themselves is noted: "At scientific conferences and meetings where Soviet scientists have participated it has become obvious that they are well informed of research developments outside the Soviet Union. Foreign books and journal articles are being translated to a considerable extent by Soviet information services. . . ."

The survey, *Providing U.S. Scientists with Soviet Scientific Information* is available on request from the Office of Science Information Service, National Science Foundation in Washington, D. C.

• • •

A new static switching device was demonstrated in New York recently by its inventor, Stanford R. Ovshinky, President of Ovitron Corp., Detroit.

According to Ovitron, the device is based upon unique and previously unrecorded electro-chemical phenomena and is inherently capable of switching and modulating almost any amount of alternating current endlessly and continuously without wear, disintegration or loss of efficiency and without moving parts, magnetic coils or other amplifying apparatus.

Ovitron believes the concept of "control through electro-ionic surface impedance changes" is still too recent a development to have found its full range of potential applications, yet its two assets, reliability and basic simplicity, are known to make it adaptable to perform a wide range of high power AC control functions.

Working models of Ovitron control units have been developed and applied in laboratory tests for functional use as proximity switches, logic devices, modulators, circuit breakers, error detectors, amplifiers, regulators and time delays.

• • •

The combining of three separate metal working methods into a single manufacturing sequence has, in part, met the increasing demands for maximum strength at minimum weight in structures and systems of high Mach number aircraft and space-borne missiles.

Developed by the United States Chemical Milling Corporation and its Missile Air Division, this sequence has been applied successfully to the fabrication of such missile parts as oxidizer and fuel tanks, nose cones, structural closures, nozzle diffusers, cylinders, eliptical, semi-eliptical and dissimilarly eliptical shapes.

The work flow starts with the shapes hydraulically spun or, alternatively, bulge formed from blanks of optimum thickness for forming rather than in the thickness required in the finished article. The parts are then machined only enough to establish tolerance relationships through the range of eventual thicknesses specified. The process is concluded with finite end thicknesses achieved through over-all or multiple-step chemical milling.

• • •

A heat sensitive coating for space satellites has been devised by Rudolf X. Meyer, of the Physical Research Laboratory at Space Technology Laboratories, Inc., (STL), Los Angeles.

The coating is designed to change color as the satellite whirls through space thereby controlling the heat absorption and radiation qualities of the vehicle.

Based on the phenomenon that light colors reflect heat while dark ones absorb it, the skin of the satellite would become light in color as the internal temperature increases, thus allowing more heat to be reflected into space. Should the payload's internal temperature take a downward turn, the skin would become dark in color, thereby absorbing more radiation.

The importance of protecting satellite payloads from temperature extremes became dramatically evident to STL scientists during the flight of Pioneer I which traveled some 70,000 miles from the Earth last October. For that experiment they calculated conditions under which the satellite instruments had to operate and a fixed temperature control paint pattern was applied. As a result, when the satellite went slightly off course, temperature conditions changed, no adjustment was possible and some of the instrumentation failed.

Many potential Earth-bound applications of STL's development will easily come to mind, such as temperature control in homes, autos, airplanes and perhaps even sunglasses with automatic light control.

• • •

A new lightweight missile regulator for use in rocket and missile engines is designed to ease fuel pressurization problems encountered in the operation of modern missiles.

Developed by the Linde Company of the Union Carbide Corp., the regulator operates on an automatic feed-back system. Missile engine design often makes it necessary to locate the regulator some distance away from the fuel tank. When the gas flow is radically altered the pressure drop through the feed line causes a change in the fuel tank pressure even though the regulator delivery pressure remains constant. The feed-back system is designed to sense the fuel tank pressure and to automatically change the regulator delivery pressure in order to maintain a constant pressure in the fuel tank.

A detailed data sheet presently is available and may be obtained upon request from the Linde Company, 420 Lexington Avenue, New York 17, New York.

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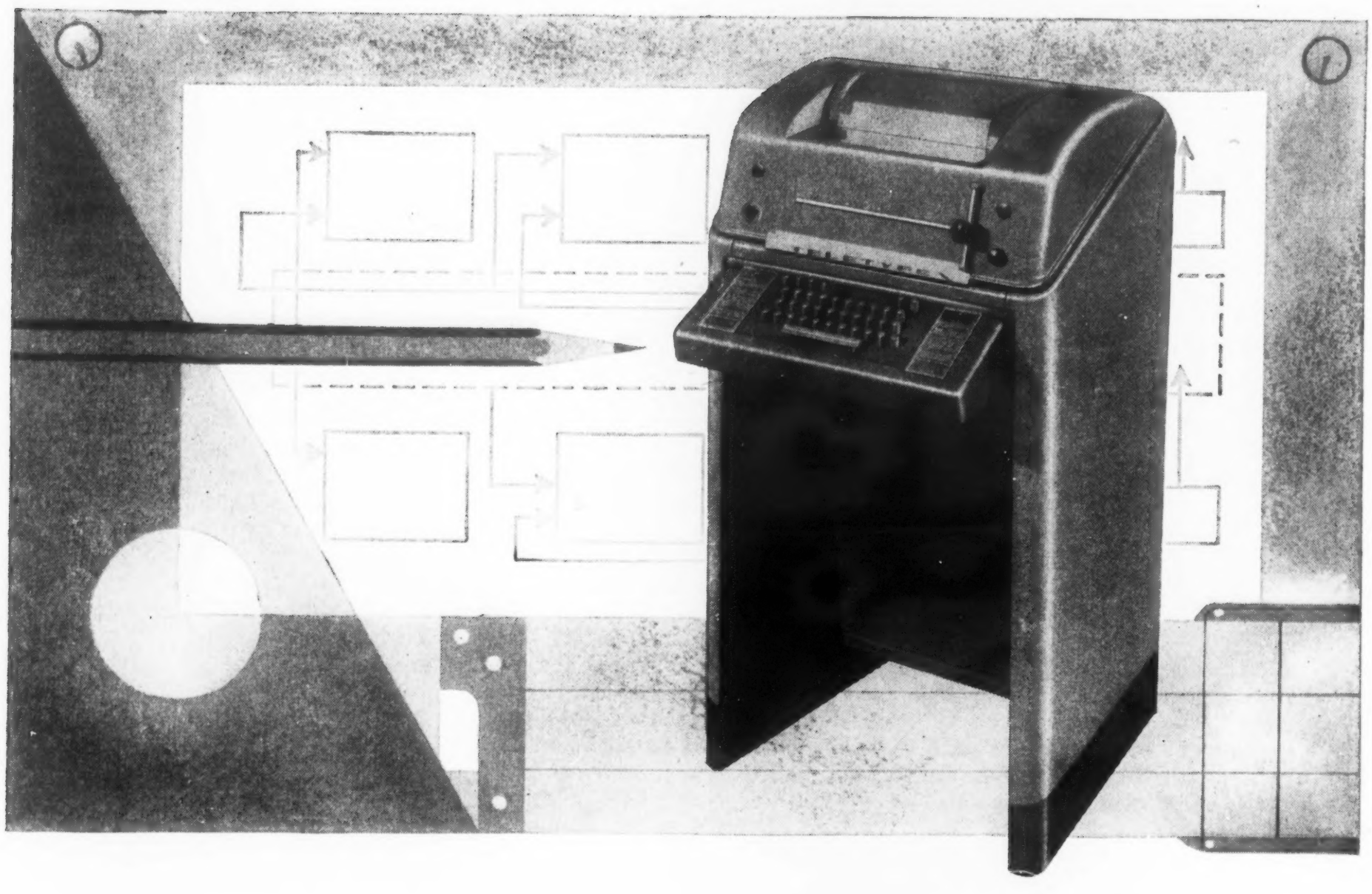
Possible establishment of a lunar garden is being investigated by scientists of Republic Aviation Corporation's Applied Research and Development Division. The study is part of a research program being conducted for the Air Force's Ballistic Missiles Division to determine the feasibility



Teletype designs for continuous operation

Dependability—the inherent ability to stand up under the grueling punishment of continuous operation—is a Teletype tradition, tested over the years in a wide variety of demanding applications. The new Model 28 Line was designed in this tradition of dependability and ruggedness, with feature after feature provided to insure long periods of attention-free operation.

All-Steel clutches, designed on internal expansion principle, give firm, uniform and accurate engagement, cycle after cycle. There is no load when idling. The lubrication interval in 100-word-per-minute operation is 1,500 hours—or 9,000,000 words.

Type box printing and featherweight carriage provide smooth, quiet operation, unaffected by tilt or vibration, assuring dependable transmission and reception aboard ship, plane, or truck. The type box is removable in seconds, without tools, for cleaning or interchange. Type alignment is built in.

Modular design. The Model 28 page printer and the other units in the 28 Line were designed for maximum interchangeability of components, mechanisms, and parts, simplifying "spares" requirements and greatly facilitating the training of personnel.

If you'd like detailed information about the Model 28 printer—or other apparatus in the Model 28 Line such as the ASR automatic send-receive set, or the tape punches and readers—write to Teletype Corporation, Dept. 73-J, 4100 Fullerton Avenue, Chicago 39, Illinois.

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of establishing a base on the Moon.

Such a garden would probably be sown within a specialized greenhouse and would offer a menu more palatable than some of the popularly mentioned space diets which often consist of such delicacies as algae, lichens and Iceland moss.

A basic aim of the study is to determine how vegetables can be grown to maturity at low pressure. Since the Moon has virtually no atmosphere, the less pressurization needed for a lunar greenhouse, the less the cost in weight and materials. The company is already experimenting with raising turnips, carrots, beets and snap beans at simulated pressure altitudes of 8,000, 16,000 and 27,000 feet.

The experiments will also determine whether or not significant increases in crop production can be obtained by lengthening the period of daylight. Earlier tests have indicated that by increasing the length of the day, the growing period for a variety of plants can be more than cut in half. A spokesman for RAC believes growing time can be expected to be reduced to possibly one quarter of that required on Earth, since a typical lunar day runs to some 14 days of continuous daylight.

RAC reports the ideal Moon vegetable would have a seed that is light per pound of vegetable produced; would be insensitive to light, gravity and cosmic rays; would not require oxygen; would provide a balanced diet of protein, fats, carbohydrates, and vitamins; would germinate rapidly; would be entirely edible, either raw or cooked, and would have a short growing period in full sunlight, at low pressures under a wide range of temperature conditions.

• • •

Automatic tactical test equipment designated as "Go-No-Go" and embodying a self-checking capability, is being put to use by Emerson Electric's Electronics and Avionics Division's new test facility at Lambert Field, St. Louis Municipal Airport. The purpose of the facility is to support the flight test of airborne electronic systems—aircraft, missile and associated components.

Developed by Emerson at the request of Convair and the Air Force, the tactical support equipment incorporates automatic rapid testing, minimum operator skill, self-checking features, flexibility and ease of maintenance, and provides complete fire control test coverage at the flight line and shop level.

The equipment is tape programmed to make static and dynamic tests on the complete fire control system and line replaceable units after automatically checking its own performance. Radar, computer, power and instrument servo devices are subjected to complete testing to determine operational readiness. Employed initially at the flight line is the Performance Test Set, a small portable unit which can determine whether the MD-7 system as installed in a B-58 is in readiness for its tactical requirements. If not, the Systems Test Set is then used to check out the entire system in greater detail. This set isolates a malfunction to the defective line replaceable unit, which is then replaced on the flight line. The defective unit is sent to the maintenance shop for repair, where a Line Replaceable Unit Test Set isolates the malfunction to a specific defective component.

The fire control system for Convair's supersonic B-58 "Hustler" bomber is an automatic airborne gun-laying system, which acquires and tracks enemy aircraft and employs a 20-millimeter six-barrel Vulcan gun, capable of firing 4,000 rounds per minute.

• • •

The tunnel diode is believed approaching commercial application as a result of an intensive research program being undertaken at General Electric.

First reported in 1958 by Japanese scientist Leo Esaki, the device is related to a transistor, but operates on a different principle and offers advantages that the transistor does not. Dr. Guy Suits, director of research at GE, predicts the improved tunnel diode will find application in high-speed computers, television sets, communication equipment, nuclear controls, satellites and space vehicles.

The tunnel diode takes its name from the physical phenomenon that makes it possible: "quantum-mechanical tunneling." The term describes the manner in which electrical charges move through the device. Such motion takes place with the speed of light, in contrast to the relatively slow motion of electrical charge carriers in transistors. These high speeds make it possible for the device to operate at extremely high frequencies. Oscillation frequencies higher than 2000 megacycles have already been obtained, matching advanced transistor performance, and frequencies of more than 10,000 megacycles are expected in the near future.

When used as switches, tunnel diodes have functioned in a fraction of a milli-microsecond—from 10 to 100 times as fast as the fastest transistor. The device also resists the damaging effects of nuclear radiation; because it is less dependent on the structural perfection of its crystal than is the transistor, it is much less affected by the damage that radiation can do to such crystal structures.

As an electrical circuit element, the tunnel diode exhibits characteristics which allow it to be used in a variety of applications, such as an amplifier, a generator of radio-frequency power, and a switching device. Entire circuits for some applications may be formed on a single semiconductor structure.

Although the improved tunnel diode is still in the experimental stage and is not yet commercially available, General Electric has plans to offer experimental samples for use in circuit design within the next few months.

• • •

A silicon transistorized tone telemetering system capable of operation within associated FM-FM telemetering system has been developed by Solid State Electronics Co., Van Nuys, Calif.

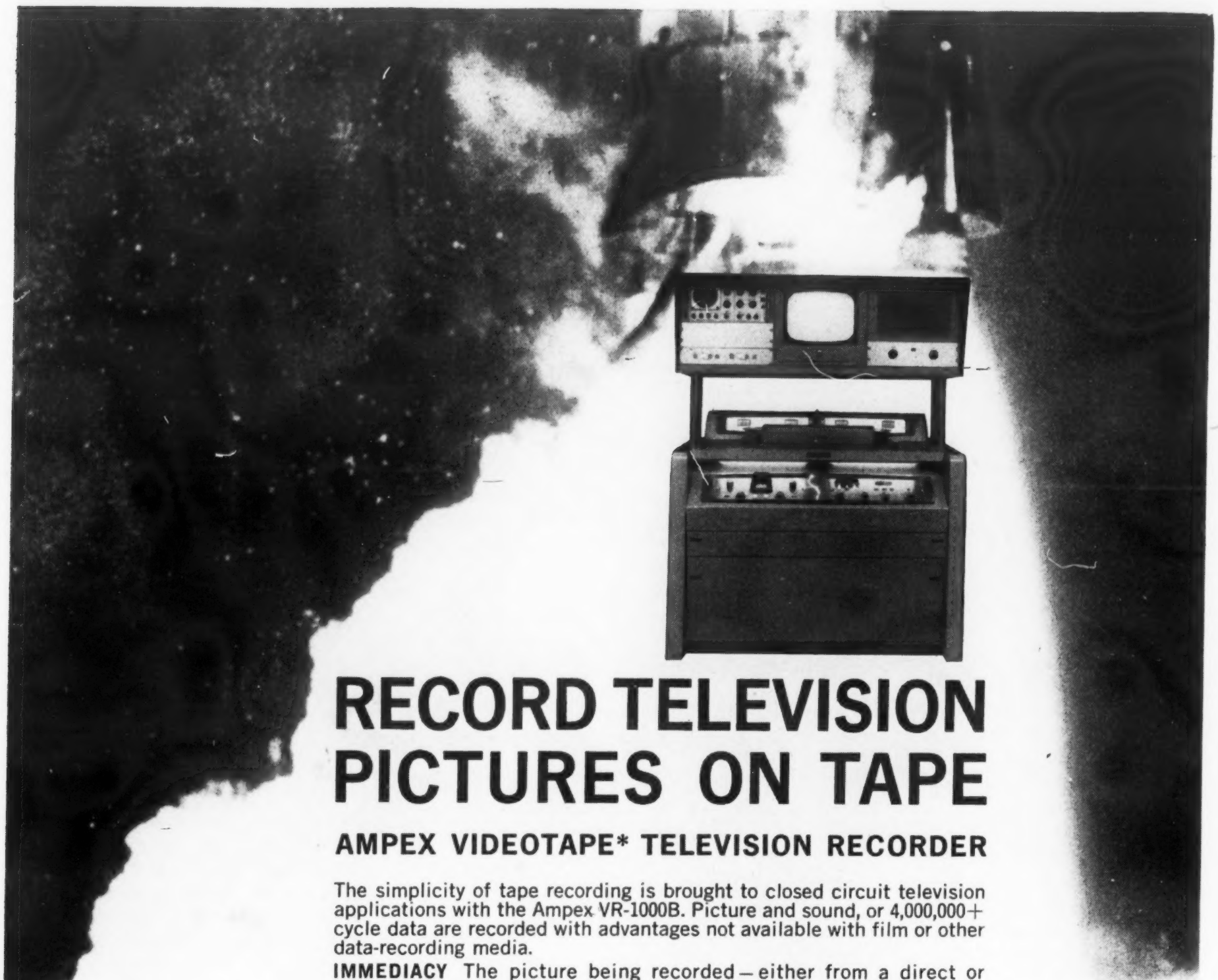
Described as a high-temperature generating system, the unit is designed to indicate the occurrence and sequence of remote functions through catastrophic environmental extremes. Output is controlled by means of a remote 28 volt D.C. supply through a gated switch. The opening of any or all gates allows the respective oscillator outputs to appear on the common bus of the summing amplifier where they are mixed. The mixed composite signal is amplified and may be fed to a transmission line or to a voltage-controlled sub-carrier oscillator for conversion to FM within a specified IRIG band. Tone frequencies may range from 25 cps to 100 kcps.

Silicon transistors are used throughout the system, designated as Model T-108, and emphasis is placed on achieving stability as a function of supply voltage, temperature, shock, acceleration and vibration.

• • •

An analog computer, developed specifically for petroleum, chemical and other processing industry applications, provides for repetitive operation at 50 solutions per second. This enables processing engineers to vary equation coefficients and observe resultant effects continuously on a 17-inch oscilloscope.

Manufactured by Computer Systems, Inc., formerly known as Mid-



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The simplicity of tape recording is brought to closed circuit television applications with the Ampex VR-1000B. Picture and sound, or 4,000,000+ cycle data are recorded with advantages not available with film or other data-recording media.

IMMEDIACY The picture being recorded – either from a direct or beamed signal from the television camera – can be monitored as it is recorded. Moments later, when rewound, the tape can be replayed on the TV monitors.

SECURITY You record, duplicate and play back your recording, independent of any outside service. And the recordings can be sent at your discretion to any other Ampex equipped facility for playback.

SAFETY The Recorder can be placed in a safe, remote location, completely removed from the television camera. The success of the recording is not conditioned by the safe return of the camera.

LIVE QUALITY The complete grey scale is captured. Video playbacks look "live". There are two separate audio channels simultaneously recorded on the same tape for auxiliary data or sound.

SIMPLICITY 96 minutes of both picture and sound can be recorded on a reel of 2-inch wide magnetic tape.

ECONOMY Full color recording can be made on the same tape used for black and white, requiring only the addition of a single electronics rack. **Tape recording is less expensive than any other recording media.**

ULTRA-HIGH RESPONSE
DATA RECORDER The Ampex Videotape Television Recorder is not limited to television recording. It will record electronic signals ranging from 0 to more than 4,000,000 cycles/per/sec. storing up to a million bits of information in less than 4 inches of tape, 2 inches wide.

Graduate engineers, thoroughly versed in government and military applications and procedures are available at Ampex to answer your questions. Address inquiries to Department 304-1. A booklet "Advanced Applications" and a technically complete brochure "VR-1000B" are yours for the asking.

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Century Instrumatic Corp. of New York City, the MC-5900 Master Process Computer, initially equipped with 202 operational amplifiers, 60 electronic multipliers, and 20 ten-segment diode function generators as basic computing elements, is expandable to more than twice this size.

The basic computer employs expanded circuit logic, so that a purchase computer may be expanded in the field on a "building block" basis without rewiring or mechanical modification.

Expansion may be accomplished in function as well as in size, the company states.

• • •

A proposed industry-wide code establishing standard test methods for relays is scheduled to be circulated this fall for comment and approval to producers of triggering devices.

Art Wood, relay engineer with the Leach Corp. in Los Angeles, and a member of the American Standards Association committee drafting the code, said distribution will follow a review meeting to be held in New York this month.

The proposed test code, Wood said, is of special importance because of the tightening reliability requirements of the missile and satellite program, which relies heavily on relays to trigger various control and firing devices.

• • •

Project MICHIGAN, the long-range research project in combat surveillance undertaken for the Army by the Willow Run Laboratories of the University of Michigan was visited recently by Secretary of the Army, Wilber M. Brucker.

The Secretary was shown radar and infrared devices which will allow future combat commanders to obtain a greater amount of information about the enemy on the battle area faster than their predecessors ever could.

Navigation and guidance devices were also included in the display as were front-line radar systems and a ruby MASER (Microwave Amplification by Stimulated Emission of Radiation) amplifier—which is a low noise radio microwave amplifier.

Reported to be impressed with the achievements, the Secretary urged the scientists to continue their efforts and to hasten the laboratory models to stages of development suitable for production.

The preliminary development of a recrystallized synthetic mica sheet was disclosed at a conference held at the Synthetic Mica Company's Technical Center in Caldwell, N. J. The meeting was attended by representatives of the General Services Administration, the National Bureau of Standards, the U. S. Bureau of Mines, the General Electric Company, Sylvania Electric Products Inc. and the Synthetic Mica Co., a division of the Mycalex Corp. of America.

Each of these companies has been conducting a research and development program for the General Services Administration to develop a mica substitute suitable for use in electron tube spacers and capacitors.

Recrystallized synthetic mica is prepared from an initial synthetic mica paper material consisting of small platelets of synthetic mica which have been reconstituted by a paper making process. Subsequent treatment of this paper under pressure and at temperatures in the 1350°-1400° C range results in the formation of a new crystal line structure having exceptional properties. These properties have been described in terms of a dielectric strength of 900 to 1300 volts per mil and a tensile strength value of several thousand pounds per square inch.

Although the material is not yet available commercially, Mycalex believes it has excellent possibilities for future military and commercial electronic and electrical application.

• • •

A Government scientist believes American children are getting wrong ideas about the atom with which they will have to deal more and more as they grow up.

According to Dr. Randall Caswell, who has six youngsters of his own, the atom is usually pictured as a nucleus with a number of electrons orbiting around it in a regular pattern, like planets revolving about the sun. Although this makes an attractive symbol, Dr. Caswell, chief of the neutron physics section, National Bureau of Standards, reports it's about thirty years out of date.

Although we can't see atoms, physicists have been learning by experiments how they would look if they were visible. An atom, scientists agree, consists of a positively charged nucleus and one, several or many negatively charged electrons in motion around and near it.

The picture of an atom as a nucleus surrounded by one or several electrons moving in symmetrical elliptical paths came in about 1916. Ten years later scientists discarded it in favor of the "electron cloud" conception suggested by Erwin Schroedinger of Germany, but it clings to life in cartoons, symbols and school textbooks.

Dr. Caswell points out that in Schroedinger's atom the electron does not travel in a fixed orbit about the nucleus, and we can never know exactly where the electron is, but we can picture its path as a cloud, like the blur made by a spinning airplane propeller.

Dr. Caswell plans to publish his ideas on the forms of the atom and molecule in a book for high school students to be illustrated by his wife. Copies of drawings of atoms may be obtained from the Office of Technical Information, National Bureau of Standards, Washington, D. C.

• • •

A new micro-miniaturized electronic circuit has recently been produced as the result of a special research program begun last September. The circuit, developed by Melpar, Inc., of Falls Church, Va., contains 15 electronic components including: transistors, capacitors, diodes and resistors mounted on a ceramic base .625 inches square and .020 inches thick and yet is smaller than a five cent coin, according to the company. It is considered to be potentially more reliable than its larger counterpart due to fewer connections which reduce the possibility of failure.

The first micro-miniature circuit was built completely by hand with the aid of a microscope. Since then a micromanipulator has been introduced to aid the precision positioning of the minute components which are part of the circuit.

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The Communications Products Department, General Electric Co. has unveiled an advance design of transistorized two-way radio equipment said to contain the highest powered transistorized models, the smallest sizes and the lowest battery drain ever to be made commercially available in the mobile communications field.

To be manufactured in the GE Lynchburg, Va. plant and marketed immediately, the equipment has been designated as the General Electric Transistorized Progress Line and will be available in units up to 75 watts—claimed to be the highest output achieved to date in transistorized communications. The 10-watt units measure 8⅝" wide, 12" long and 4"

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They're known as countermeasures.

To you, they could represent the difference between life and death.

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Active countermeasures may jam the radar which guides a missile. Or blind its electronic eyes. Or deflect it from its course. Or help seek it out and destroy it—miles from its target.

They Cannot Wait

If an attack ever comes, there are only minutes in which to act.

ITT is one of the companies holding the stop watch.

More than 15 years ago, in fact, the Department of Defense anticipated missile warfare and assigned ITT to countermeasure development.

Since then, many have been perfected. Others are now being tested. Still others are being rushed to completion. Some are active countermeasures. Others are passive countermeasures, which record hostile electronic activities.

Hundreds of ITT scientists and technicians, specialists in fields such as physics, astronautics, electronics, chemistry and metallurgy, are devoting their energies to the job.

At their disposal are the facilities of 101 growing research and manufacturing plants.

Many Other Big Jobs

Countermeasure development is one of the many areas in which ITT is engaged for the defense of the United States.

Guiding, controlling and testing missiles—to defend, to retaliate—is another vital area of activity.

Still another is the creation of a split-second global communications system for the Strategic Air Command.

And the development of earth satellites another.

The all-important job of operating and maintaining the DEW Line, our Distant Early Warning radar network in the Arctic, is also an ITT assignment.

Countermeasures Come First

The potentiality of missile warfare is a fact we must face squarely, realistically and *quickly*. Countermeasures must be on call. ITT will help to get them there in time.

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high, and contain only three tubes. Even with the size reduction, the units outperform larger conventional models.

The entire assembly is made of modules which plug into each other, facilitating quick field repairs. The units will be available in both narrow band, for new licensees, and wide band, for replacement use in existing communication systems where desired.

• • •

A transistorized, high-writing speed, 20 cps-200 kc graphic level recorder (Type 1521-A) with a variety of uses in electronics, acoustics and other branches of physical sciences and engineering, is now available from General Radio Co., West Concord, Mass.

The instrument records the rms magnitude of an ac voltage (on a logarithmic scale) rather than the instantaneous value and can plot the output of an ac device as a function either of time or some other parameter that can be made time dependent, such as frequency.

A high-speed null-seeking servomechanism, of novel design, serves to position a logarithmic potentiometer and a pen to produce an ink trace on rectilinear paper. Three interchangeable potentiometers, with ranges of 20, 40 and 80 db, are available. Maximum writing speed is adjustable up to 20 inches per second.

A wide range of paper speeds are provided 2.5 in/min, 7.5 in/min, 25 in/min and 75 in/min. This flexibility of speeds permits not only long-period studies of noise produced by traffic, office machinery, industrial processes and potential hearing-damage environments, but measurements of short-duration transients. Basically, the instrument can be used to plot not only level versus time and lever versus frequency, but analyze frequencies.

Dimensions of the recorder, available for bench or relay-rack mounting, are: 9" high x 19½" wide x 14¼" deep, over-all. In either bench or relay-rack design, and for 50 or 60-cycle supply, the 1521-A is priced at $995.

• • •

The V-Dot Indicator, a shock detection system capable of protecting shipments of delicate equipment and instruments in transit, has one moving part, an indicating ball, held in center position by a controlled magnetic field, factory-set to withstand normal handling and shocks up to a pre-set standard. A shock greater than the allowable maximum from any direction in a single plane will dislodge the ball from the center and trap it against the edge of the circle. A set of two or three indicators will protect shipments from shocks from all directions. Once the indicating ball is trigged it can be moved back to the center only by breaking the lead inspector's seal and opening the case.

The V-Dot Indicator was developed by Inertia Switch, Inc., of New York.

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Experimental production of light-wall seamless metal tubing that can be shipped in ribbon form and inflated at the point of use will begin this fall by Calumet & Hecla, Inc., of Allen Park, Mich.

The new material will be known as "Strubing" (strip tubing) and is said to promise potential innovations for such industries as construction, electric power distribution, communications, rockets and missiles, farming, packaging, and chemical manufacturing.

Calumet describes the major advantages of Strubing as first, point-of-use inflatability which makes it possible to ship thin-wall tubing economically — since only the tube "walls" are shipped and not the "hole" and second, the process used in making Strubing. Technically classified as cold rolling, the process provides an economical means of producing thin-wall tubing of materials and in thickness either unavailable today or available only at prohibitive cost.

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The newly developed vernitel, a revolutionary departure in the field of FM/FM telemetry which is to make possible for the first time the transmission of data with high accuracy over standard existing FM/FM telemetering systems, was recently shown by Hoover Electronics Co., Timonium, Md., subsidiary of the Hoover Co., North Canton, Ohio.

Vernitel, according to engineers on the staff of the electronics research and development firm responsible for its perfection, upgrades telemetry system accuracy to a point at which it is comparable to that of PCM systems, with a minimum of alteration or additional investment at either the transmitting or receiving end. The heart of Vernitel is a special quantizer which continuously separates the information voltage into a coarse voltage of 16 discrete levels, and a vernier of residue voltage.

Names in the News

Frank A. Gunther has been elected Executive Vice President and General Manager of Radio Engineering Laboratories, Inc., a wholly-owned subsidiary of Dynamics Corporation of America. In his new post as operations head of DCA's "communications subsidiary," he will direct the company's multifaceted activities in the communications field.

Frederick R. Lack has been elected to the Board of Directors of DuKane Corporation and of Sprague Electric Co. He retired from his position as Vice President of Western Electric Company in August 1958.

Brigadier General Kenneth F. Zitzman, former Deputy Commandant, Industrial College of the Armed Forces, Fort Lesley J. McNair, retired recently and has joined ITT. His offices will be located in Paris.

Walter A. Kirsch has joined Servo Corporation of America as a sales engineer in the Weapons Sub-Systems Sales Department. Mr. Kirsch joins the company following a three-year association with Fairchild Camera and Instrument Co. as superintendent of electrical assembly and manufacture on the SAGE project.

Brigadier General Charles M. Baer has become Commandant of the U. S. Army Signal School, Fort Monmouth, N. J. Previously, he was in Paris as Chairman of the European Military Communications Coordinating Committee of NATO and Chairman of the Civil Communications Planning Committee of the North Atlantic Council, NATO.

Howard A. Zeimer has been promoted to the position of Manager of the Military Liaison Department of CBS Laboratories, Stamford, Conn. Prior to his appointment last year as Assistant Manager of the Department, Mr. Zeimer had served as Field Liaison Representative for Radiation, Inc. and Hycon Manufacturing Co.

James W. Goodin, who served more than thirty years with the U. S. Army Signal Corps Research & Development Laboratory at Ft. Monmouth, N. J., died August 14. As a pioneer with the R & D Program, Mr. Goodin contributed much in bringing it to its present importance within the Army and Department of Defense.

An achievement in defense electronics

HALF CUBIC INCH 90 DB AMPLIFIERS FEATURE NEW CERAMIC TRANSFORMERS

New 455 kc three-stage amplifiers developed by the U.S. Army Signal Corps utilizing the facilities and competence of General Electric provide as much as 90 db gain with 5 kc bandwidth in a volume of one-half cubic inch. This degree of miniaturization evolved from sustained research and development in solid state filters, delay lines and transformers at the Electronics Laboratory, Electronics Park.

The unique bar-shaped transformers developed for these amplifiers, combined with improvements in existing ferro-electric ceramics, permits the most compact packaging with extreme gain. This achievement in research and development is indicative of General Electric's technical competence in defense electronics.

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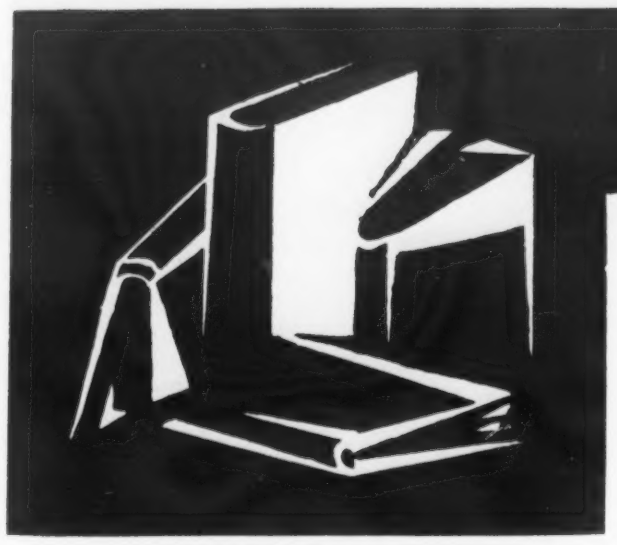


Books

HOW PHOTOGRAPHY WORKS, by H. J. Walls. The MacMillan Co., New York, 1959. 351 pages, $8.50.

This book is intended for those interested in the scientific background of photography. It explains the whole of the photographic processes by taking the reader on an informative and entertaining tour through several regions of modern science—optics, chemistry, and visual perception.

The guide, H. J. Walls, a Scotsman, is a graduate (B.Sc. and Ph.D.) of Edinburgh University who also did post-graduate work in physical chemistry at Munich and Bristol. He is presently director of the Forensic Science Laboratory in Newcastle, England. He treats the subjects of exposure, development, printing, and color in common sense language that doesn't omit the difficult parts. When penetrating beneath the surface of these subjects, the author supplies in graded doses the scientific facts and reasoning necessary for their understanding.

Having read this book, you may or may not become a better photographer—but you will at least know why some people are.

AUTOMATION, CYBERNETICS AND SOCIETY, by F. H. George, Ph.D. Philosophical Library, N. Y., 1959. 283 pages, $12.00.

Those individuals who are acutely aware of the scientific developments which confront world civilization and their potential to advance or destroy it, will perhaps find clarification in this book of some of the problems involved in aligning scientific progress with that of human society.

Automation — one of modern science's most striking manifestations —scientific methods of organization, how they may be viewed in the evolution of science and the social changes which scientific planning will bring are dealt with in this book.

The age of automation will see whole fields of daily human labor revolutionized and lives shaped and molded by the machine. The possibilities are endless and consequently the cause of much confused thinking and many doubts. How far will it reach and where will it lead us? How little is known of control and communication systems, a study sometimes called cybernetics, and its application as automation. Although there is much exciting development of the various disciplines of logic, psychology, physiology and philosophy in these new fields, these are not purely the problems of the scientist: there is probably no one whose life will not be influenced by automation.

THE SOVIET AIR AND ROCKET FORCES, Edited by Asher Lee. Frederick A. Praeger, Inc., New York. 1959. 311 pages, $7.50.

As we move further into the age of guided missiles, the strength of the Soviet air and rocket forces becomes an increasingly powerful factor in the future strategic planning of the Western world. In this book, which is a companion volume to *The Soviet Navy* (Reviewed in SIGNAL, April 1959), American, British, German and Russian experts pool their knowledge to provide a comprehensive, authoritative evaluation of Russian air strength today.

Numerous aspects of Russian experience regarding Soviet air power are examined ranging from the daily life and training of a Soviet airman to the political control of the Soviet Air Force; from the history of Soviet air arms to a projection of their future.

Various experts discuss their field of experience: a former Soviet officer, a military editor, a Luftwaffe commander, a British Air Chief Marshal, and others.

COMPREHENSIVE ANALYTICAL CHEMISTRY, Volume 1, Part A. Edited by Cecil Wilson and David Wilson. Elsevier Publ. Co., N.Y., (D. Van Nostrand Co., Inc., distributors), 1959. 577 pages.

Comprehensive Analytical Chemistry will comprise five volumes, some consisting of several parts and covering all types of analytical determinations. Volume One, Part A, deals with introductory and general material that may be of importance in any branch of analytical chemistry, and with processes of such long standing that they are usually referred to as classical analyses.

Recent developments in analytical chemistry have made it highly desirable that branches already well-established should be reappraised in the light of new knowledge and modern materials. By obtaining contributions from experts in their own fields, it has been possible to present authoritative accounts, often from several different aspects, of such fundamental topics as the nature of the materials used by the analyst, problems of sampling and statistics as they affect analysis and methods of weighing and of measuring volume. Recent developments such as organic reagents and the application to inorganic analysis of extraction methods are also discussed.

There are complete and up-to-date sections dealing with gas analysis, qualitative inorganic and organic analysis, and general aspects of gravimetric analysis. The remaining classical material will be presented in the succeeding parts of Volume I.

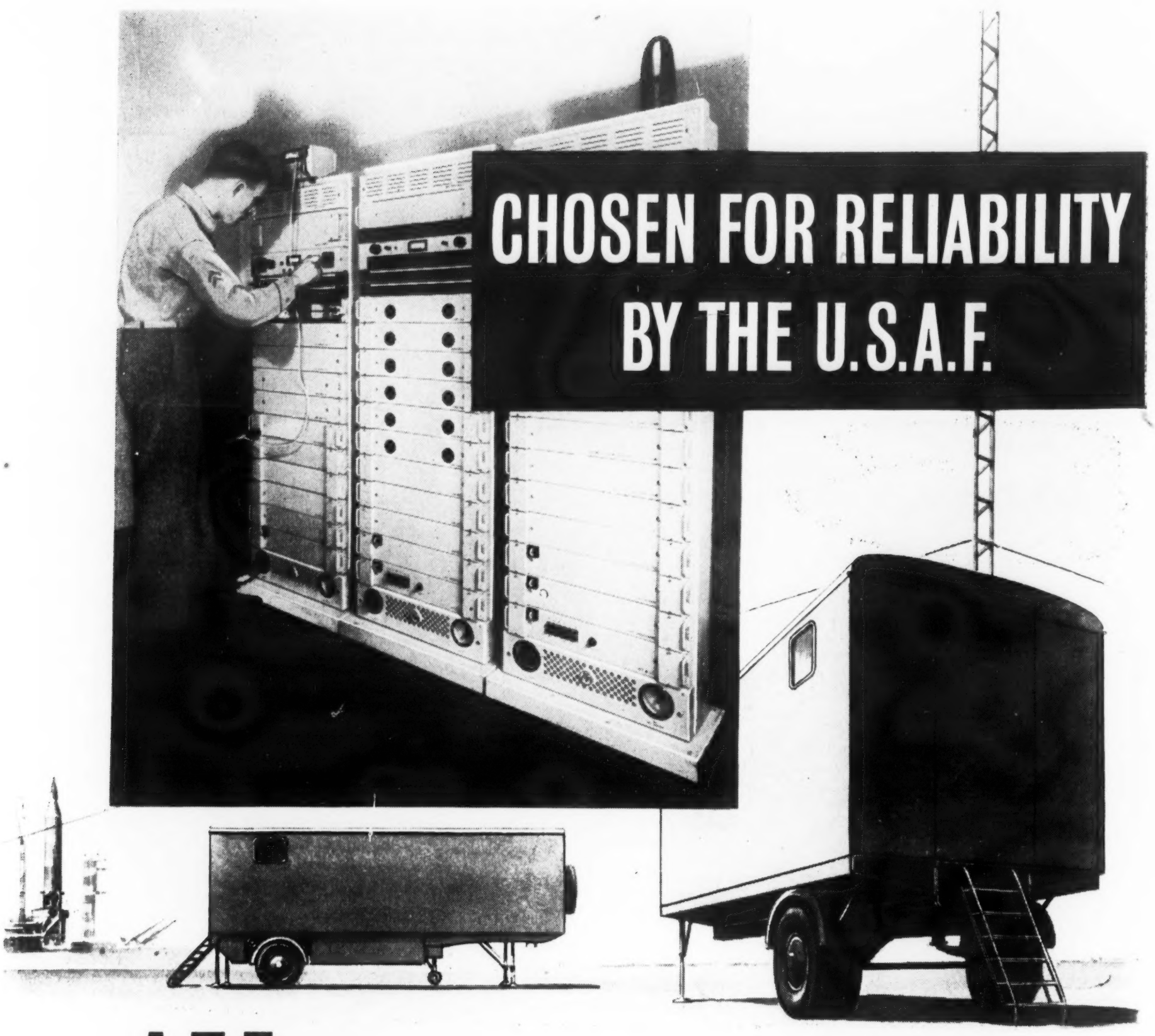
MATHEMATICAL PROGRAMMING AND ELECTRICAL NETWORKS, by Jack B. Dennis. Co-published by The Technology Press of M.I.T. and John Wiley & Sons, Inc., N. Y., 1959. 186 pages, $4.50.

A new point of view on mathematical programming based on an analogy with electrical networks is presented in the third volume of a series published by The Technology Press.

The series is designed to make selected timely and important research studies more readily accessible to libraries and independent workers. The research reported in this volume was part of the program undertaken by the author toward the Doctor of Science in Electrical Engineering at M.I.T.

It is shown that any direct-current electrical network made up of current sources, voltage sources, ideal diodes and ideal transformers is equivalent to a pair of duel linear programs. This relation is extended to embrace a correspondence between direct-current networks including resistors and quadratic programming.

A simple algorith is developed for solving diode-source networks which is applicable to networks flow problems including the familiar transportation problem. A procedure for algebraically tracing the breakpoint curve of a diode-source-resistor-transformer network is derived, and employed to obtain optimal solutions to general linear or quadratic programs. Finally, it is shown that the direction of steepest descent appropriate to a general programming problem is determined by a quadratic program, and a method using this result is proposed.



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Chapter News

(*Continued from page 62*)

Scott-St. Louis

Over 100 members and guests were present at the June 12 dinner-meeting of the chapter. After the new members and officers were introduced, Henry M. Altepeter, Inventory and Cost Engineer for Southwester Bell Tel. Co., gave an illustrated talk entitled *Electronics, Automation and You.*

Seattle

At the recent annual celebration, the following were named directors of the chapter for 1959-1960: Alfonzo Baird, Western Union; Phil Stewart, Alaska Communication System; past president Lee David, Boeing Airplane Co.; Capt. James E. Parrott, USN (Ret.), and Cdr. Burton H. Weston, DCO. 13th Coast Guard District.

Personnel Available

As a service to AFCEA members, SIGNAL will make space available in this column for those members who are interested in employment in the communications, electronics and photography industries. Any member is entitled to three insertions in the magazine on a space available basis, free of charge. Please limit your notice to 5 lines. In replying, employers are asked to address: Box ....., SIGNAL, 1624 Eye St., N.W., Washington 6, D. C. Letters will be forwarded to the AFCEA member.

FIELD REPRESENTATIVE with thorough knowledge of government procurement practices with respect to R&D and production contracts in communications and electronics. Presently employed in eastern area, desires to relocate in Florida. Box 150.

Membership Certificates and AFCEA Insignia

Available for immediate purchase: Lapel button for civilian dress, bronze—$1.50, sterling—$2.50 and gold—$5.00. AFCEA official medal, bronze—$3.00, silver—$4.00 and gold—$5.00. 3" dia. decalcomania, 4 for $1.00. Membership certificate, $1.50.

All insignia may be ordered from: AFCEA Service Dept., 1624 Eye St., N. W., Washington 6, D. C.

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for
words

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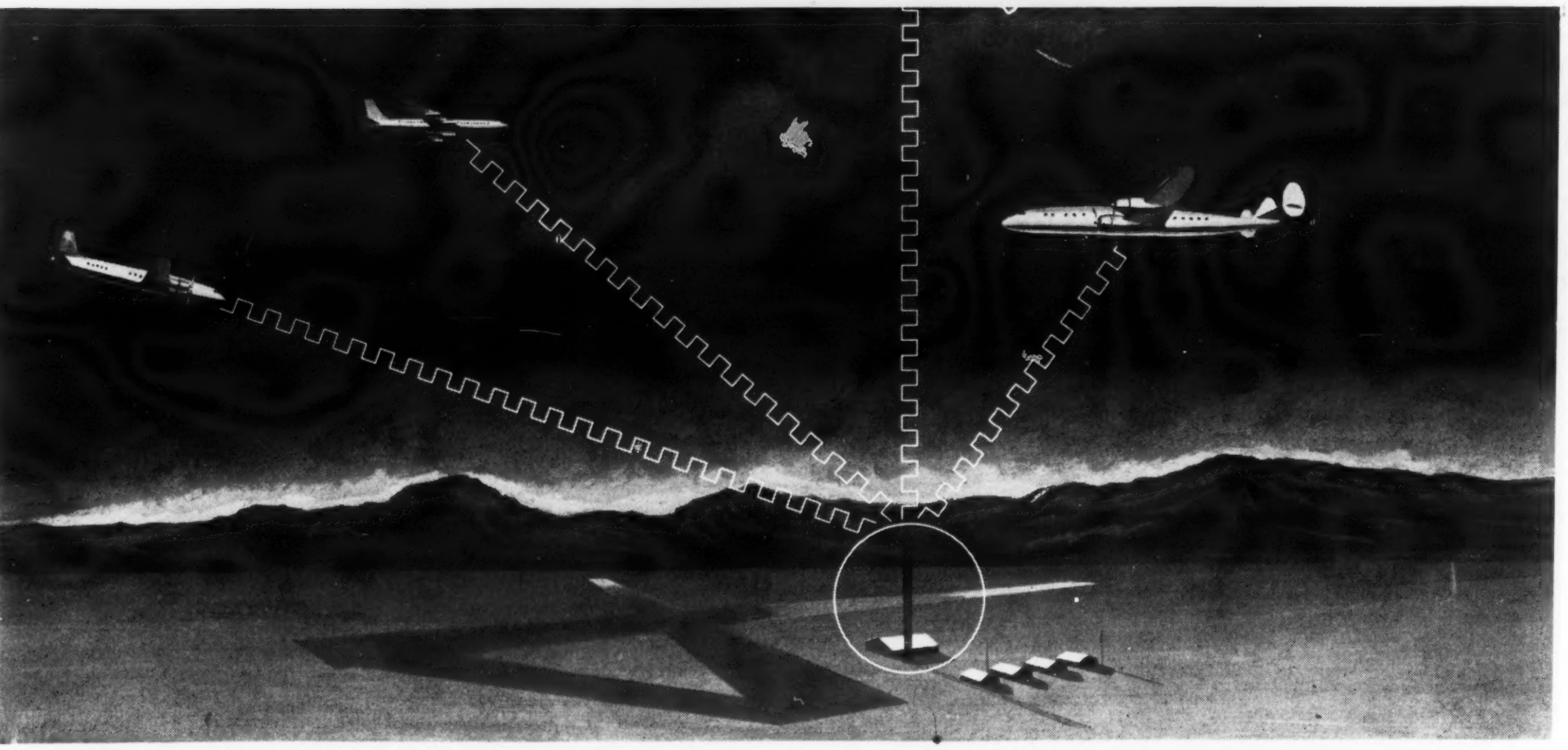
"AJAX"



AGACS, Experimental Automatic Ground/Air/Ground Communication System is a new concept in Air Traffic Control Communications to meet the accelerated pace of increased air traffic. Primary objectives are efficient usage of frequency spectrum, added safety through increased reliability and reduced burden to pilot and controller, and adaptability to all classes of aircraft. AGACS provides compatibility with existing ground and airborne communication equipment, selective addressing of information, and a minimum number of frequency changes during flight. The system utilizes two-way time division data transfer over existing ground and air communication links to provide an automatic, mutual exchange of information. The airborne facilities display to the pilot the last significant Air/Ground and Ground/Air message quantities, while the controller may recall from central memory-storage equipment the last Air/Ground and Ground/Air message quantities for display. The AGACS program is still in the developmental stage. In August, 1959, RCA provided initial models of both airborne and ground equipments for the Bureau of Research and Development of the Federal Aviation Agency for extensive experimentation and flight tests.

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DEFENSE ELECTRONIC PRODUCTS

CAMDEN, N.J.

Tmk(s) ®

The Landing of the Puritans

On the banks of Gitchie Goomie,
Lake the white men call Atlantic
Heap big redskins going frantic,
*Radar got no Bomac tubes!**

See the Pilgrims land on rock there!
See them cross the sky blue water!
Redskins know they hadn't oughter,
But radar got no Bomac tubes!

Beat the drum, call heap big powow,
Call the braves from heap big teepee,
Get um chief to put on toupee —
Radar got no Bomac tubes!

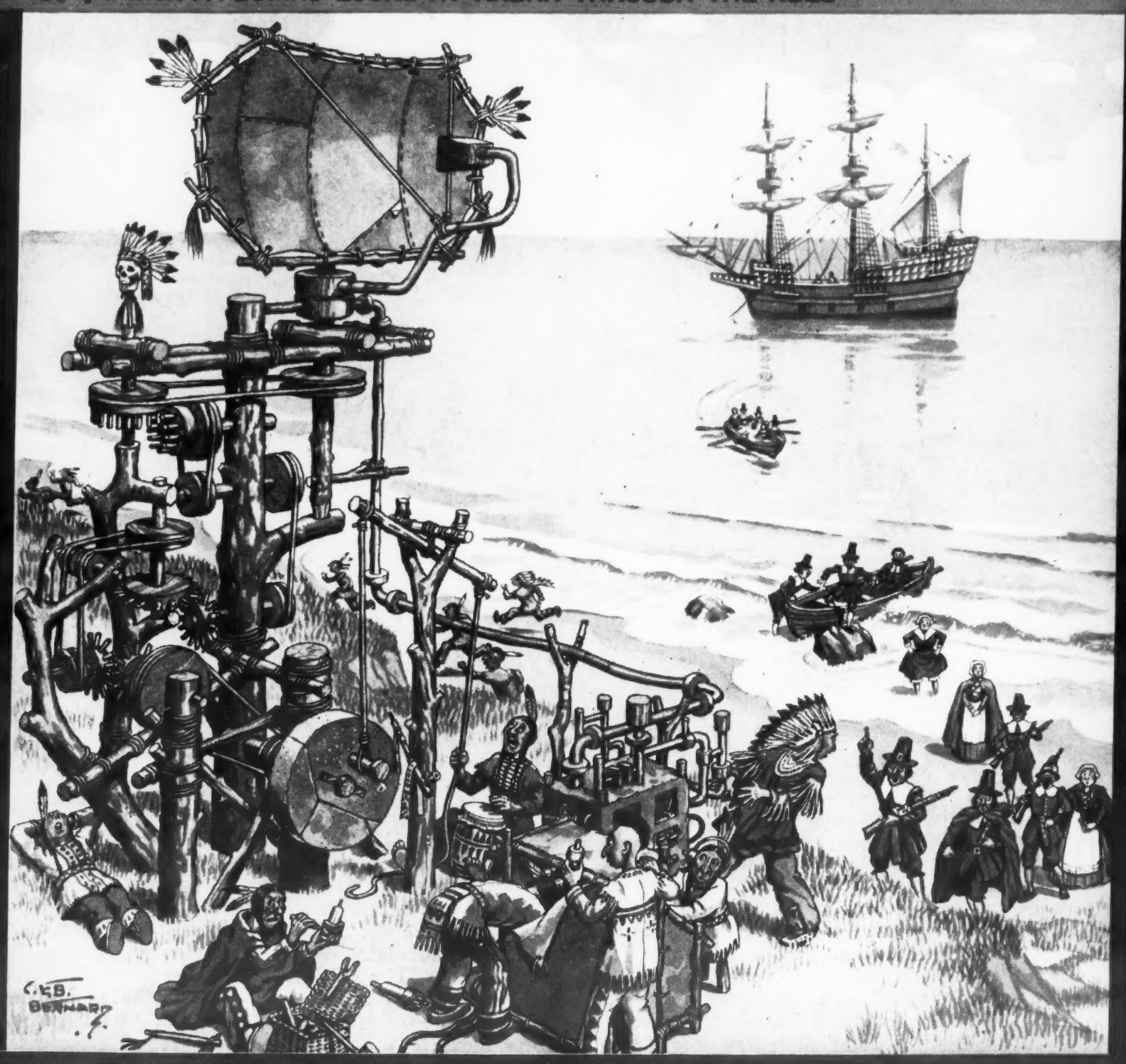
Fixum Cavity, Bald Eagle!
Get um faulty Klystron going!
Heap big white men come a-rowin
And radar got no Bomac tubes!

Storm Cloud, get those fingers flying!
Mend with rawhide, patch with sticks
Too late now to get um "fix" . . .
Radar got no Bomac tubes!

Redskin radar rests in ashes,
White men use um wood for fire, now.
Price of real estate is higher now . . .
Radar had no Bomac tubes!

On the banks of Gitchie Goomie
Different people now are living,
Every year they give Thanksgiving
Radar had no Bomac tubes!

No. 15 of a series . . . BOMAC LOOKS AT RADAR THROUGH THE AGES



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October 1959
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The excellent high frequency response of the amplifier types permits the practical design of communications systems at frequencies up to 60 mc.

For complete data and application information, write Dept. S-1059.

*Trademark Philco Corp. for Surface Alloy Transistor.
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PHILCO

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Famed red telephone is at left. Device at right is internal alert dial system for alerting headquarters personnel.

This is one of the most important telephones in the free world

A vital link in the nation's communications network, widely dispersed for safety

The phone is at Headquarters, Strategic Air Command. In the event of attack, orders would be given over it *simultaneously* to every SAC base, thus launching a massive retaliatory force against the enemy.

To a great extent, America's defense communications use the existing Bell Telephone network, which operates on land, through the air, and under the oceans. *Today that network is so widespread and diversified that the resulting communications reliability is one of our important defense resources.* Important telephone routes bypass major target areas. Many different means of communication back each other up, so that if one is lost another is available.

The Bell System has also helped create communications for such vital defense projects as our far-northern Distant Early Warning radar line for protection from aerial attack. And it is at work now on communications for BMEWS — the Ballistic Missile Early Warning System. These are just two of the many defense jobs that we have undertaken.

Swift, dependable communication is our business, whether to speed the cheerful voices of home and industry, or the sterner voices of defense.

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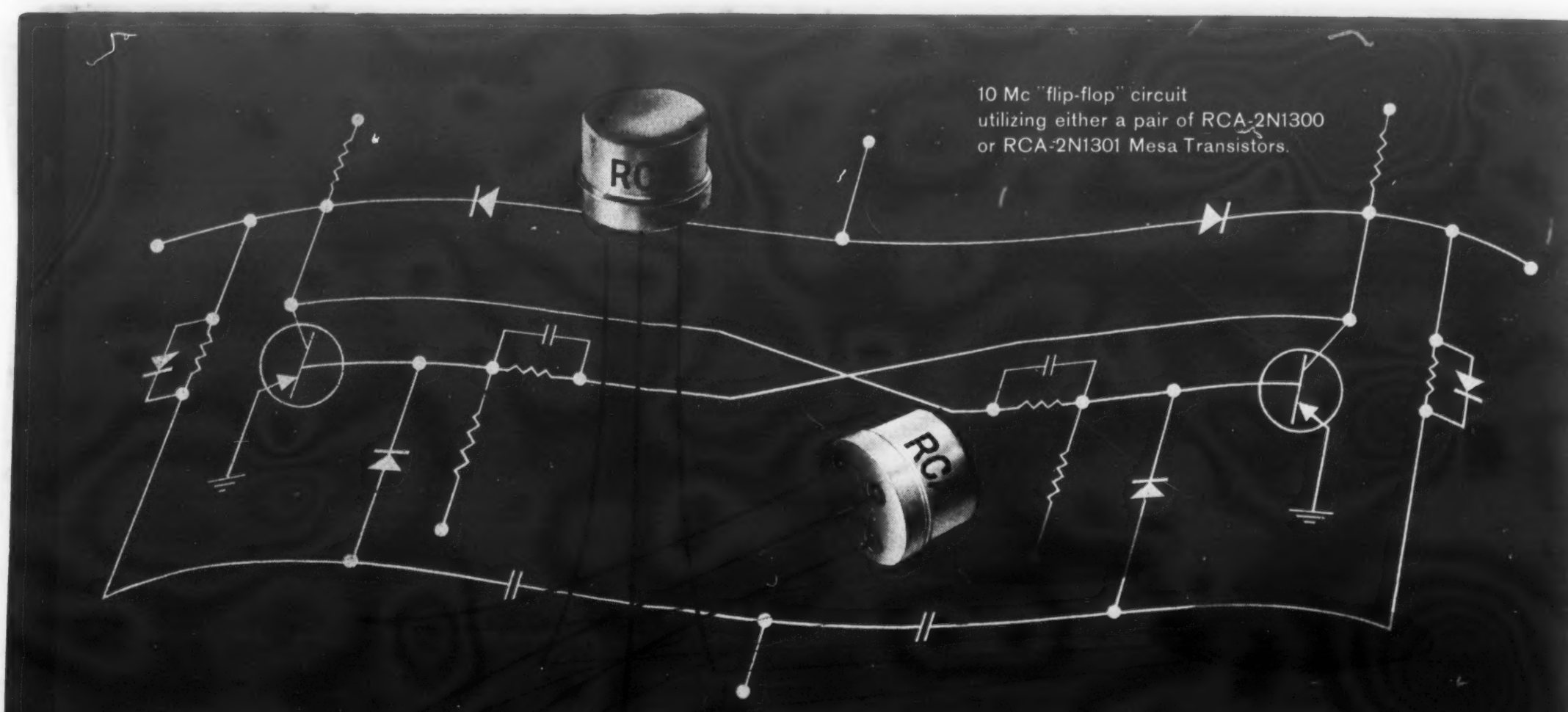

RCA-2N1300 and 2N1301

LOW-COST MESA COMPUTER TRANSISTORS

Now in quantity production . . . and available!

RCA-2N1300 and 2N1301 Germanium P-N-P Mesa Transistors offer these 10 major benefits to designers of switching circuits. And they're ready for you now!

- rugged Mesa structure—permits extremely small base width to insure top performance at high frequencies
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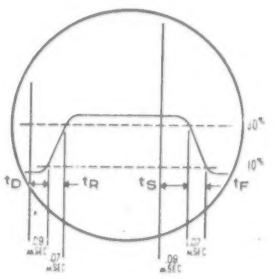
- high breakdown voltage and punch-through voltage ratings—the result of the diffusion process
- high power dissipation—150 milliwatts at 25°C—aids in the design of reliable circuits
- high current ratings—improve overall system speed
- rugged overall design—units have unusual capabilities to withstand severe drop tests and electrical overloads
- electrical uniformity—a result of the diffused-junction process used by RCA in the manufacture of Mesa Transistors
- especially well suited for use at pulse repetition rates up to 20 Mc
- exceptionally well suited to applications in saturation-type switching circuits

RCA TYPE	Maximum Ratings▲ Absolute-Maximum Values						Characteristics: Common-Emitter Circuit, Base Input Ambient Temperature of 25° C		
	Collector-to-Base Volts	Emitter-to-Base Volts	Collector Milli-amperes	Transistor Dissipation—mw			Minimum DC Current Gain		Gain Bandwidth Product● Mc
				at 25°C	at 55°C	at 71°C	at collector ma = −10	at collector ma = −40	
2N1300	−13	−1	−100	150	75	35	30	—	40
2N1301	−13	−4	−100	150	75	35	30	40	60

▲Maximum collector-to-emitter voltage rating = −12 volts

● For collector ma = −10 and collector-to-emitter volts = −3.



Oscilloscope wave form shows typical delay, rise, storage, and fall times achieved with 10-ma inverter circuit utilizing the RCA-2N1301 MESA TRANSISTOR.

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